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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[NOTICE.]

The July Meeting of the Pacific Coast Gas Association.

PACIFIC COAST GAS ASSOCIATION,
OFFICE OF THE PRESIDENT,
SAN FRANCISCO, CAL., May 24, 1905.

To the Members of the Pacific Coast Gas Association:

Date of Meeting.—Attention is again called to the coming meeting of the Pacific Coast Gas Association, which will be held in this city, July 18th, 19th and 20th next, a little less than two months distant.

Question Box.—Mr. E. C. Jones has kindly consented to edit the Question Box for this year's meeting, and inquiries in connection therewith should be sent to him, his address being 628 Rialto Building, San Francisco. The Question Box is a department of the Association work which is of continually increasing importance, and Mr. Jones' editorship will insure success, especially so if the members will make free and unhesitating use of his valuable services.

New Members.—What have you done towards increasing the life and value of the Association by adding new members? Blanks have been furnished you for this purpose, and if you have not already sent a name or two to the Secretary it is earnestly hoped that you will soon do so, as you must certainly know of some eligible and desirable person whom we would like to welcome as an active member, or firm as an associate member.

Department Editors.—Do not overlook the fact that Mr. G. S. Colquhoun, of Fresno, is the "Wrinkle" Editor; Mr. R. P. Valentine, of Sacremento, is the "Experience" Editor; Mr. G. H. Hollidge, of Oakland, is the "Novelty" Editor; and Mr. Geo. P. Low, of San Francisco, is the Association Historian. All of these departments need your assistance.

Programme.—An excellent programme is being arranged and all members should now begin arrangements to be present.

Very sincerely and fraternally, L. P. LOWE, President.

[NOTICE.]

Question Box, Pacific Coast Gas Association.

PACIFIC COAST GAS ASSOCIATION,
OFFICE OF THE PRESIDENT,
623 RIALTO BUILDING,
SAN FRANCISCO, CAL., June 5, 1905.

To the Members of the Pacific Coast Gas Association: The Question Box has become an important part of the meetings of Eastern Gas Associations, and it has been found a most valuable means of conveying needed information on subjects directly relating or tangent to our business. It is desired that our Association shall have a creditable Question Box at the coming meeting, to be held in San Francisco, July 18, 19 and 20.

I have been honored by being appointed Editor of the Question Box, and I urge the hearty co-operation of every member of the Association to make it a success. The time is short and there is much work to be done.

Please send to me questions, the answers of which will be of help to you, and I will use every effort to have them properly answered by the

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members of our Association. Our Question Box will differ in some respects from those of other Associations, inasmuch as neither the name of the one who asks nor the one who answers the question will be made public, and no question will be answered by simply "Yes" or "No," but wherever possible, good reasons drawn from experience will will be given.

Please send at least one question *now*, and it will be appreciated by,

Yours faithfully, E. C. JONES, Editor.

[OFFICIAL NOTICE.]

Respecting the Official Work of the American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION,
SECRETARY'S OFFICE,
530 Broadway, N. Y., Dec. 13, 1904.

To the Members American Gas Light Association: As there seems to be some misunderstanding respecting the standing of the official management of the Association, members will please note that the undersigned is the Secretary of the Association, and that Mr. A. E. Forstall is carrying forward the work of the Practical Class. All correspondence in connection with the Practical Class should therefore be addressed to Mr. A. E. Forstall, 58 William street, and all other matter dertaining to the Association to MR. GEORGE G. RAMSDELL, Secretary. at the above address.

[NOTICE.]

Wrinkle Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE WRINKLE DEPT.,
719 CITIZENS BUILDING,
CLEVELAND, O., June 13, 1905.

The Wrinkle Department of the Ohio Gas Light Association is now ready to receive contributions for the 1906 collection, and a sketch or description of all devices, formulæ and methods of accomplishing objects pertaining to the gas business, is respectfully solicited.

Please send a written explanation, accompanied by any sketch, photograph or drawing, to the above address, or a description alone will suffice.

Hoping to receive prompt compliance, Yours very truly,

E. W. STEINWEDELL, Editor.

BRIEFLY TOLD.

COMMENCEMENT WEEK, STEVENS INSTITUTE OF TECHNOLOGY.—The programme for commencement week, Stevens Institute of Technology, Hoboken, N. J., which excellent seat of tuition acknowledges this week its 33d year, shows that President Humphreys and his associates have laid out a busy time for the "Profs.," the students and their guests Actually, the week was begun yesterday, with the Baccalaureate sermon, delivered yesterday morning at Trinity Episcopal Church, Hoboken, by the Rev. J. Clayton Mitchell, and its ending will not be recorded until after the close of the farewell reception tendered by the Junior Class to the Graduating Class and friends, the evening of Thursday next, at the Carnegie Laboratory of Engineering. On the morning of Wednesday the exercises incident to Class Day of the Graduating Class will be held on Castle Point Campus, and the afternoon and evening will be marked by the reception to the Trustees, Faculty, Alumni, Graduating Class and friends and Undergraduates, by President and Mrs. Humphreys, in the Carnegie Laboratory of Engineering. Thursday morning will mark the 33d Annual Commencement, convened, of course, in the auditorium of the Institute.

NOTES—

MR. P. W. SHARPE has resigned from the service of the Marlboro-Hudson Gas Light Company.

THE formal arrangements for the taking over of the plant of the Elgin (Ills) American Gas Company, as part and parcel of the properties of the Western United Gas and Electric Company, of Aurora, Ills., have been carried to completion.

THE Mohawk Gas Company, of Schenectady, N. Y., is arranging to extend its main system to the outlying village of Scotia.

THE competition in the lighting of Mexico City, Mexico, has been brought to a close through the purchase by the Mexican Light and Power Company of its rivals, the Mexican Gas and Electric Light Company and the San Ildefonso Company.

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.—CONTINUED FROM PAGE 928.]

TWENTY-EIGHTH ANNUAL MEETING, WESTERN GAS ASSOCIATION.

HELD AT CHICAGO, ILLS., IN THE AUDITORIUM HOTEL, MAY 17, 18 AND 19.

FIRST DAY—MORNING SESSION.

Discussion on the paper[1] on "Cement Joints," by Mr. J. D. von Maur.

The President—Mr. von Maur's paper is before you. I hope there will be free discussion.

Mr. Steinwedell—I would like to ask whether the hubs in these cement joints were of any special diameter or special depth, or whether they were just the same hubs that would be used with lead.

The Secretary—The following contribution to the discussion of the paper on "Cement Joints" has been received from Mr. Ralph Woodward, of Pittsfield, Mass.:

Mr. Woodward—I do not feel that I can add much to the discussion on the subject of cement joints. The subject has been well threshed out by Mr. von Maur and his conclusions are most exhaustive. It would seem that the cement joint is the joint for gas companies to use. In my own experience I have been making almost exclusively cement joints for 20 years, and believe them to be the best possible joints for a gas company to make. Any good Portland cement may be used; but I have used with good success the Orchard Roman cement (an imported Scotch cement), for the reason that it is very quick setting and is not quite so hard and brittle when set as some made with American Portland cements. It is, however, so quick setting that during hot weather we have to mix a certain proportion of Portland cement with it to get the best results. I believe the Association is greatly indebted lo Mr. von Maur for his paper, and it should settle this question for all time.

Mr. Mitchell—I would like to ask Mr. von Maur what his experience is in laying large pipe in hot weather. How is it about the expansion? How does he manage the expansion of the pipes during the hot weather?

The President—Mr. von Maur will reply to all these questions at the close of the discussion.

Mr. Forstall—Mr. President, I don't think Mr. von Maur has quite answered the objection to the use of cement joints in the business portions of cities by the statement that he gives on page 16. I don't doubt that he is able to answer that objection, but he has not answered it by what he has said there, because he has not made it plain, if it is so, that there are as many miles of cement jointed mains in the business section of St. Louis as there are miles of lead jointed mains. There will always be more breaks, more leaks, in the business portion of a city than there will be in any other portion of the city, no matter what joint is used in laying the mains, so that the fact that there are more leaks in the business portion of St. Louis, and that these leaks are on lead jointed mains is not conclusive as to the advisability of using cement joints in the business portions of the city unless we have a comparison between lead and cement in that business portion. In the same way, on page 24, where he speaks of it being the accepted opinion that cement should not be laid in soft places, I don't think he has answered the objection there. As I have always understood it, the difference between a pipe laid with lead joints and one laid with cement joints in case of settlement is that the lead joints will give and make a number of small leaks, while the cement joints will not give, but the pipe will ultimately break and make a large leak, and the question as to the advisability of using cement joints or lead joints in places where leaks are apt to occur depends upon whether it is better to have a number of small leaks, or whether it is better to have one large leak, which, while it will be detected more quickly than the smaller leaks, is more apt to make trouble before it is detected than the smaller leak.

Mr. Waring—I would like to ask Mr. von Maur, when it becomes necessary to take up a main, the best method of removing the cement joints.

Mr. Doty—I would like to say that my experience rather coincides with that of Mr. Forstall, and my judgment somewhat goes the same way. I have felt that in business sections of the city where we are more liable to have disturbance, it is better to lay lead joints, for the reason that, while we may have a number of small leaks they won't be so dangerous. A cement joint, to my mind, while it is a rigid and a tight one, is very liable to break the main in case of a disturbance in the street, and we are very apt to have from the breakage of the main a dangerous leak, which is liable to cause an explosion, whereas with the lead joint the leakage is not apt to be so very serious at the

1. For the text of the von Maur paper, see *ante*, Vol.

moment. Another point that occurs to me is on page 16. Mr. von Maur reports that, referring to Mr. Brownell's tests in his "Electrolytic Survey of the City of St. Louis:" "This test certainly shows that a cement joint has a great advantage over a lead joint from a purely electrolytic standpoint." I would like to ask Mr. von Maur how he sustains that position. I think it is generally recognized that cement is practically a non-conductor, and while lead is not a good conductor it is nevertheless a conductor. As I understand the theory of electrolysis, the danger to the pipe comes where the current leaves the pipe, and the introduction of any resistance will tend to drive the current from the pipe, and it seems to me that, therefore, you will have the current leaving the pipe at every joint and carrying with it the iron and so destroying the pipe. With the lead joint you do not have this tendency to such an extent. Therefore, to my mind, and I believe it was the generally accepted opinion, the lead joint was a better joint to use to safeguard one to a certain extent—not wholly, but to a certain extent—against the dangers from electrolysis, and I thought that I had Mr. Brownell's own expressions in support of this. I recently received a copy of an electrolytic survey made by Mr. Brownell, for Mr. F. H. Shelton, of one of Mr. Shelton's companies in Pennsylvania, and Mr. Brownell in that report, as I read it, certainly gave his testimony in favor of using a lead joint to minimize as much as possible the destruction of the pipe by electrolysis. I would like to have Mr. von Maur sustain his position on the cement joint as an advantage over the lead joint from purely an electric standpoint.

Mr. T. D. Miller—I think Mr. Doty has made a very serious error in his discussion of the cement joint and lead joint as concerns preventing electrolysis. If every joint in a main is a cement joint, and the resistance of that cement joint is so high, the electricity will not go to the main with near the facility that it will when the joints are lead and are better conductors. The introduction of an occasional joint of high resistance would have a tendency in the ordinary run of the pipe to attract the current to the pipe for that run and then leave the pipe; but where you have practically non-conducting joints every 12 feet, the chances are that the current would not go to the pipe at all, because resistance along that pipe is much greater than the ground itself, or perhaps than the rail immediately in the vicinity. Now, my experience on electrolysis is that as soon as you create a little better conductivity in your main you get more current, and the bonding of the two rails to the points where the current leaves the pipe will have a tendency to make the pipe take more current out in the sections of the city where the current is going through the pipe. Wherever it strikes a joint of high resistance it will jump around and create damage there. Therefore, I believe that universally the use of cement joints will have a tendency to reduce electrolysis throughout the entire system of mains. The question of using cement joints in soft ground, as against using lead in preference, and because of the protection and elasticity of the lead joint, has been raised. We would be barred from using cement joints entirely in New Orleans if that were the case. The entire system of mains in that city is laid on 2-inch plank to act as a sort of float you might say to hold up the pipe. It is true that the tendency to break is greater, but where there is so much soft soil the foundations are so poor that there is usually a good deal of water. A bad break of a main where there is a good deal or water, or a break of any kind, unless there is a very high pressure, would have the tendency to let the water into the main instead of the gas out. That is one of the troubles that we have to contend with; it is not gas leaking out of our mains but water leaking in.

The President—Mr. Miller says he uses cement joints exclusively in New Orleans. Does he have no lead joints; no expansion joints of any kind whatever?

Mr. Miller—We have a great many lead joints there. I think it was two or three years ago I had a very decided argument with Mr. Shelton on the train (Mr. Thwing and Mr. Barret were there), and I argued in favor of the lead joint for soft ground. They bore me out in it. I have changed my mind. We are using cement joints entirely there. We are having a great deal of sewerage and conduit work going on there now, and it is a very common thing for us to have a block or two of main sink as a result of the excavation in the vicinity, cutting off our main from quite a section of the town by the sinking of the main and the letting of the water in. Last month, while we had to raise about 7 or 8 blocks of main and regrade it, we had but 2 broken mains during the month.

Mr. Fullerton—In Schenectady, N. Y., we use cement joints exclusively. We don't allow for any expansion or contraction. We use 5-inch bells. Last summer we had occasion to lay about 1,600 feet of pipe, where we had to sheet pile the whole length of the ditch, and the bottom was very soft, in fact, kind of quicksand. We placed a 2-inch plank for blocking about 2 feet long under each end of pipe. That pipe gave us no trouble. The drip has not caused any more water. To stop the water from washing the cement off joint we tore the cement bags in two, doubled up the half of bag and filled it with dry cement and wound it around the joint and tied it there. Those joints gave no trouble since then. That is very nearly a year ago.

Mr. Doty—I would like to ask Mr. Fullerton what kind of joints he used in Buffalo?

Mr. Fullerton—Cement joints exclusively. I will say that for 3 years they have had no broken mains with cement joints in Schenectady. In Buffalo we had quite a few with lead joints.

The President—Any further discussion on this topic? Is Mr. Searle in the room? Mr. Shattuck? Mr. McAdam?

Mr. McAdam—It is very evident from Mr. von Maur's figures that cement joints are cheaper than lead. It is a cheaper joint; but why should Mr. von Maur's figures for labor be shown in favor of cement? I contend that a lead joint can be made much quicker than a cement joint. I have done it; I have seen it done. Or is Mr. von Maur figuring his labor on the unskilled basis? If so, I think there is danger there, from the fact that those unskilled men may suddenly feel that they are skilled, after they have made joints for some time, and tell you so. The consequence is that they will demand just as much for their labor as you pay the caulkers. That means trouble, and if they don't get more money they will certainly give you poorer work. A poor cement joint is worse than a poor lead joint. The difference in cost really ought to be in the lead. There again I believe Mr. von Maur could shave off some of the cost. Lead seems to me to be too high. In Milwaukee we use from 15 to 25 per cent. less lead than St. Louis does, and we have got no trouble from leaky joints, because they are well made. In the winter of 1904-5 nearly all of our main system was in frost. We had only 6 broken mains, 4 of which were caused by sewerage, 2 where the services were tapped into the mains, and only 1 of which was in the business district. At different points in Milwaukee, and within a radius of 600 feet, we had a difference in the depth of frost of nearly 2 feet. There is where your expansion and contraction come in. Now, I doubt if a cement joint could be used to any advantage in a condition such as that. I doubt it. I will say no. It is not expansion and contraction of a pipe that we have to contend with so much as in the ground. But still I don't believe that there is 1 out of 100 of us who pays any attention to expansion and contraction while laying lead joints. We talk about it in papers and at the meetings, but that is about all the attention we pay to it. For instance, you go to lay a pipe and the pipe is lying on the edge of the trench. In the warm weather that line of pipe certainly receives all its expansion from the heat of the sun. But should you do that work in a busy district, where you must use all care and all haste to get the work completed, you naturally would flush a portion of the ditch. We do. And I am confident that if you uncover that whole stretch of pipe through a block, you would not find one of these lead joints leaking, provided you made the joint tight in the first place. Cement could never stand that. I believe that it is a case of locality, and when the condition is such as we have in Milwaukee, I don't believe that it would be advisable to use cement joints.

The President—Any further remarks, gentlemen, on this topic?

Mr. Haines—We have used cement joints in Des Moines for some 20 years, and I do not agree with the gentleman who just spoke in regard to the labor conditions. I believe that any intelligent laborer can make a first-class cement joint A lead joint requires more skill of the mechanic type, but a cement joint can be made by an intelligent laborer, and by almost any intelligent laborer, if he is properly instructed, in a very short time. The proportions of cement to water that are given the laborers can be gotten by proper measures, and care must be taken in not allowing the cement to become partially set before it is used in the joints. I think another point in regard to lead joints that has not been brought out is that when a lead joint is driven too hard in the main it places the main under tension and makes it less flexible as it is being laid than a cement joint does; that is to say, that when a lead joint main is laid the driving up of the lead draws the entire main into tension, and when the trench is filled in it is liable to be and necessarily must be more or less depressed or elevated by tamping in the dirt around the main. In the cement joint the cement is placed in the main when the pipe is bedded on its foundation, and does not draw the main into tension, and, therefore, it gets a better and more even bedding than it can under lead joint conditions.

The President—Any further remarks? If not, Mr. von Maur will close the discussion.

Mr. von Maur—The first question asked was whether we used the same bell for lead as cement? We do.

The second question, I believe, was what precautions do we take in laying large pipes during hot weather? In every case we fill in between the bells before any joints are made. This is to make the pipe rigid, so that it will not move or be disturbed after the joint is made, and also to partially cover it from the sun. In laying large pipes in addition to the above, we cover the joint, after it is made, with burlap and keep this burlap wet by sprinkling water on it from a sprinkling can. As soon as the test is made we immediately commence filling in and endeavor to get all the pipe covered as soon as possible. Care must be taken in filling in not to jar the joints with the rammers.

3d. Regarding Mr. Forstall's remarks as to whether it pays to lay pipes with cement joints in the business sections of the city, I will say that there is only one way to prove this absolutely, and that is to try it If we are following any certain practice, such as making joints with cement, and find that it is a success throughout the city where it has been tried, and that lead joints have not been a success in the business sections of the city, why is it not good policy at least to make the experiment and try the cement joint in the business sections of the city? We intend to do so. I might say that since this paper was written we made an experiment with a 4-inch line of pipe, with cement joints, parallel to a steam railway and only 10 feet away from the rail. It has only been in for a few months, and I do not know whether we will have any trouble with it or not, but this line replaces a cast iron main which was laid with lead joints, which main leaked and broke continually. A serious accident resulted from one of these leaks and also resulted in an expensive lawsuit for the company. I have every reason to believe that the present main, laid with cement joints, will cause us far less trouble than the one it replaced.

4th. As for laying pipe in soft places, my contention is that the experiments we made showed that a pipe laid with cement joints did have more elasticity than we usually supposed it had. We showed in one experiment that the pipe sagged 15 inches before a leak developed. You will hardly ever get more sag than this, even in soft ground. Furthermore, we have laid pipes in soft ground, which have now been in use for over 2 years, and up to this writing we have had no trouble from them.

5th. As to removing the cement from the joint when it is necessary, I have always found that this was a very hard thing to do. I know of no simple process by which this can be accomplished. At present we are simply go uging the cement out.

6th. Regarding electrolysis, I cannot agree with Mr. Doty that it is the universally accepted opinion amongst engineers that it is better to have a good conductor than a bad one for your pipe lines. Where does the damage from electrolysis become most serious? Is it more on the service pipes than it is on the main pipes? I have always found that it is a great deal more serious on our wrought iron and steel pipes than on our cast iron pipes. If we make a perfect electrical connection with the street railway tracks, the current is conducted through the mains and from the mains to the service pipes which frequently pass under the tracks. The current leaves here for the rails, causing the damage—more so, I believe, than if the mains had been made a poorer conductor and less current had passed through the system. Furthermore, I believe that the general policy of connecting up our pipes with the street railways, and making them a part of their system, is a very bad one. If at any time the street railway company makes a change in the location of the power house, or the circuits, the electrical conditions previously existing in the gas system of mains and services may be thoroughly changed and you would have to do all your work over again. We have a line of pipe in St. Louis, made of cast iron pipe with lead joints, and thus of low electrical resistance, and yet we have found that unprotected services on this line are destroyed in about 5 weeks. Measurements made on this line show a very strong current flowing through it, so that this would illustrate very well the damage to the service pipes to be entirely due to the heavy current flowing through the main. I believe that had the main been insulated the current would have been less and the damage correspondingly decreased.

7th. Referring to the matter of costs, I can only say that the costs that are submitted in my paper are based on actual experiments.

8th. Whether pipe can be laid in frost or not I am not prepared to say, except that I am given to understand that in Chicago a line of 16-inch pipe was laid with cement a number of years ago, and on writing the Engineer of the Peoples Gas Light and Coke Company, asking whether they had any trouble with this line, I was informed that they never had any trouble from it. Now, I should judge the frost in Chicago would reach about the same depth as in Milwaukee; I may be mistaken. Since they have no leaks in Milwaukee in pipes laid in the frost with lead joints, then there cannot be any movement of the pipe line, and if there is no movement of the pipe line, then cement should do at least equally as well as lead, for it must be remembered that the main advantage claimed for a lead joint is that when the frost moves the pipe it causes a number of lead joints to move slightly, the line not being rigid. This would result in a number of small leaks around the joint.

9th. As for any danger existing from strikes on account of training a large number of laborers to make cement joints, I believe that the more laborers we train to be expert men the better off we are going to be. Last spring we made it distinctly understood that no caulker or foreman could work for the company during the coming winter who was not able to make cement joints by December. It is surprising what a large number of good men we developed in a short time. In carrying out this policy we practically flood the market with good men, who, while not really expert caulkers, are expert cement joint makers. This is a good thing for the company and a good thing for the men.

On motion of the Secretary a vote of thanks was extended to Mr. von Maur for his very excellent paper.

The President—The next paper on the programme is on the

USE OF TAR AS FUEL IN BENCH FIRING,

by Mr. F. C. Sherman, of New Haven, Conn. As the author is not present the Secretary will read the paper:

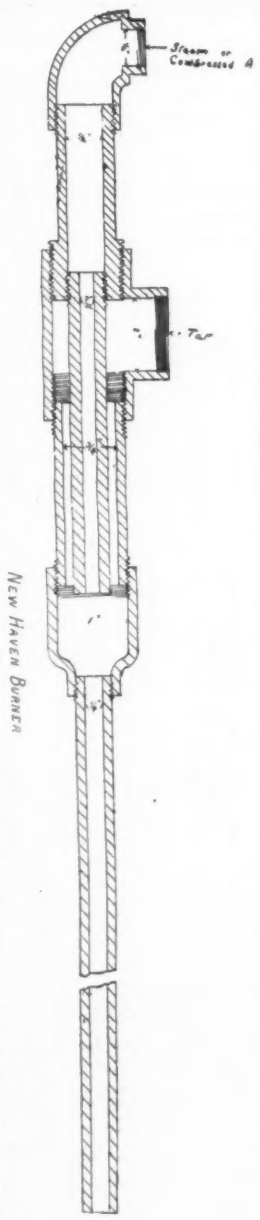
At the request of your Secretary, I submit "Some Notes on Tar Burning." I do this most willingly, for from what I know of the tar market and the inquiries I get in regard to burning tar, the difficulty of disposing of it and the utter lack of demand in New England for water gas tar, this question of disposing of it is a "burning one," and is forcing itself upon the attention of the managers of gas works. I am convinced that in many instances too little attention has been given by the engineer in the matter of consuming tar in the retort furnaces and in the steam generating plant. A short and unsatisfactory trial has discouraged them and caused them to abandon it. They have brought up against the smoke nuisance, variable heats, destructive cutting flame on settings and obstinate stokers who object to any change in firing, even when it reduces their labor. The number of papers that have been read before the different gas associations on this subject is legion and is only equalled by papers on naphthaline. There would seem to be no excuse for the ignorance in regard to the feasibility of using tar for fuel or of its value as compared with solid fuel. Still with all of this available information, tar is being offered at prices far below its value as fuel. It is easier to sit down and denounce the tar combine than to make persevering efforts to burn it successfully; and here I would say that I think we have an exaggerated idea of the profits of the tar trusts.

In tar distilling four-fifths of the residual product is pitch and most of the time this is a drug in the market. To any who are thinking of experimenting with tar as fuel in their retort furnaces I will tender the experience of the New Haven Gas Company for 25 years in its successful use, and if this record is of any service to them in solving any difficulties that may overtake them in their first efforts in this direction, and be the means of relieving the glut in the tar market, I shall feel amply repaid for jotting down these brief notes on an old, threadbare subject.

The New Haven Gas Company has burned its surplus tar for the last 25 years. What I mean by surplus tar is that which we cannot dispose of at its value for fuel purposes. In other words, if we cannot sell it for its fuel value, we burn it. We have tried several burners, among them the Parsons, and the Standard Oil Burner. The one we are using for the last 10 years I first saw at the works of the Newark (N. J.) Gas Company. It is a very efficient burner, giving very little trouble in the way of clogging and costs a very moderate sum. I inclose cut of it, and also send you a sample burner ready to connect. Any gasfitter can make one. Our feeding tar tank 4 feet by 9 feet is placed alongside the retort house, elevated 20 feet, the tar running by gravity to furnace. In winter we heat the tar in tank by steam coil. It is desirable to have a large tank for uniform pressure at the burner. Compressed air or steam can be used with this burner. We fitted up a Westinghouse air pump in retort house, giving 16-inch water pressure, We get the best results with a steam jet. In order to overcome the variations in steam pressure, we use a regulator which keeps a uniform pressure of 50 pounds on burner. The tar is pumped to receiving tank, passing through a screen that removes the dirt and lumps. The tar valve is open full and quantity admitted to furnace is regulated by

steam jet; if more tar is required steam pressure is reduced; if too much is being admitted pressure is increased. There is but very little smoke if the steam pressure is kept uniform and the valves adjusted if smoke is produced, and here we run against the stoker who has got into ruts. He prefers to shovel and clinker rather than adjust a steam valve occasionally, and unless he is kept up to his duty, smoke will fill the retort house, and this incomplete combustion will close the flues of the settings, occasioning serious annoyance and loss. We have had to let down benches to remove the solid carbon in the flues. We use benches of 6's, half-depth furnaces, and work on 4-hour charges; use ½ coke produced, or 65 bushels in 25 hours; 150 gallons of tar will do the same work in our furnaces. Given the price of coke it can be easily figured the worth of tar for fuel. We get 10 cents a bushel for our coke, which would make our tar worth $2.16 per barrel of 50 gallons. We make all our steam with water gas tar for which there is no demand in our State; besides making all of our steam with water gas tar, we use it under our retorts, the same burner used with coal tar and with equally good results. We use in our steam plant a different burner from that used under retort benches. On the outlet of our retort furnace burner we put an atomizer such as is used in the oil distributers in the Lowe water gas apparatus. This sprays the tar and steam in the boiler furnaces. We take the water gas tar from a separator and pump it into the receiving holder tank, getting in this way oil gas tar free from water. We have found very little difference in the life of our retorts and settings since we substituted liquid for solid fuel. We find for steam making three barrels water gas tar is equal to 1 ton bituminous coal.

I close this paper by saying that, with our present methods of burning tar, it should not be disposed of for less than its real fuel value.



Discussion.

The President—Gentlemen, this paper is before you for discussion. Mr. Baehr, will you speak?

Mr. Baehr—Mr. President, I have a few notes here on some evaporative tests that we made in St. Louis to determine the value of coal gas tar and water gas tar. I would like to say that the results that are gotten from the burning of tar naturally depend very largely on the percentage of water in it, any considerable per cent. reducing the calorific value of the material and consequently the method of burning the tar, the apparatus for burning it, the size of the combustion chamber, etc., have a very large influence on the result. St. Louis has cheap fuel coal, and I will give you the tests. Evaporative test of Zeigler mine run coal, which mine is owned by Joseph Leiter. The cost of that coal (mine run), delivered in our quarters, is $2.07 per ton. The calorific value determined in the laboratory was 11,207 B.T.U. to the pound. At the time of making the test the boiler thermal efficiency was only 66 per cent. I am unable to say why it was so low. I have not a full report with me. The equivalent evaporation from and at 212° F. of a pound of coal was 7.8 pounds of water. After determining the evaporative value of the Zeigler coal we got some Pintsch gas tar. This tar analyzed at the time of the test $4\frac{5}{16}$ per cent. of water. The calorific value per pound of tar was 12,104 B.T.U. That is a low value for tar, and the large percentage of water undoubtedly accounts for it. The weight of this tar per gallon was 10.83 pounds. The boiler thermal efficiency at the time of the test was only 43 per cent. That shows that the combustion chamber, the apparatus for burning this tar, was not properly adapted to get the best results. The equivalent evaporation per pound of tar was only 5.33 pounds of water. The commercial value compared to Zeigler coal, and I am quite sure that its commercial value was computed without taking into consideration the boiler efficiency at the time of the test, was only .79 of a cent. per gallon. Subsequently a test was made with water gas tar. The percentage of water in the tar at the time of the test was .2 per cent. The calorific value of the tar was 16,495 B.T.U.; boiler thermal efficiency, 59 per cent.; equivalent evaporation per pound of tar, 9.96 pounds of water. The commercial value compared to Zeigler coal per gallon of tar was 1.27 cents. I think there is no question, Mr. President, but that the value of tar would be considerably above the figures we arrived at in these tests if the apparatus was of the most improved kind and we had a higher boiler thermal efficiency. The combustion chambers are not well adapted for tar burning. The boilers under which these tests were made were Heine water tube boilers of about 2,225 square feet of water heating surface.

The President—Any further discussion? If any gentleman has an idea on this subject we would be very glad to hear from him. We want to make the discussions more general, if possible.

Mr. Waring—I would like to say that on the E. & W. boilers we got an efficiency of 13.88 evaporation per pound of tar.

The President—13.88 pounds of water per pound of tar. Was that coal or water gas tar?

Mr. Waring—Water gas tar, free from water.

Mr. Haines—I would like to ask Mr. Baehr if that cost of coal at the boilers ($2.07 per ton) includes the entire labor of handling the coal and moving the ashes incident to it; whether that is all the labor incident to using coal?

Mr. Baehr—My recollection of that figure is that the cost of removing the ashes is included, but I would prefer to look up my record before giving a definite answer on that point.

Mr. Haines—I would like to ask Mr. Baehr whether that equivalent value of the tar also includes the labor reduction in the handling of tar?

Mr. Baehr—I am unable to say. I can give the gentleman those figures after I return to St. Louis. I had to make most of those figures from memory.

Mr. Fitzgerald—I would like to ask Mr. Waring where he got that 13.88 pounds of water to the pound of tar, how he regulated his air, how much air he put under the furnace? Did he carry the furnace doors open or keep them closed in making the test?

Mr. Waring—We used a tar device, which, I think, was gotten up by Mr. Prichard, of Lynn, Mass. We don't admit any air at all under the grate bars. We don't change our settings at all. We have stationary grates, and we merely put clinkers over the grate bars and close the ash doors tight. The spray is a steam pipe under the tar pipe, which merely atomizes the tar, and air is drawn in through an opening in the firedoor. The reason we use this device is because we can change from tar to coal in a very short time. I got my remarks reversed. I meant to say that we do admit air from the ashpit, and Mr. Prichard advocated not admitting air in the ashpit. We had a serious explosion, burning the fireman and engineer who happened to be in front of that door, by gas generating in the ashpit. After that we merely cracked the door to admit enough air to carry away the gas. We get splendid efficiencies by burning tar. Our tar merely gravitates from an overhead tank.

The President—Any further remarks. Does the Secretary desire to close the discussion?

The Secretary—No, sir.

On motion a vote of thanks was passed to Mr. Sherman.

A recess was ordered until 2 P.M.

FIRST DAY—AFTERNOON SESSION

The sessions were reconvened, pursuant to motion for recess. The President introduced Mr. W. A. Baehr, of St. Louis, Mo., who, as Editor thereof, presented the following

BUDGET FROM THE WRINKLE DEPARTMENT:[1]

Upon assuming the duties of Editor of this department last year I at once began to revolve the possibilities of the wrinkle work in my mind. Almost all of my predecessors had stated that the field was becoming exhausted and that securing new wrinkles was growing more difficult each year. I accepted this view partially, and thereupon set out to determine if new fields existed. There are fields, and ample ones, too, but the use of them for this purpose depends very largely upon the limitations imposed upon the Editor by the definition the Western Gas Association gives to the word "wrinkles." If you confine this work to a record of those usually simple and practical devices which enable us to

1. The Wrinkles were read by Editor Baehr by title only.

overcome the minor difficulties of our business, you limit the field and render it extremely difficult for the Editor to really devote much earnest effort to it.

If, however, our worthy Association will broaden the definition to include all devices, formulæ, expedients and scientific methods of accomplishing objects appertaining to the entire gas business, in addition to the minor practical devices, the field is unlimited. Wrinkle and progress departments, question boxes, etc., can all be considered as educational institutions, and consequently there can be grades of wrinkles, as well as educational grades in school. I preferred to consider the broader definition of the word "wrinkle" as before mentioned, and with that as a basis requested contributions for the year.

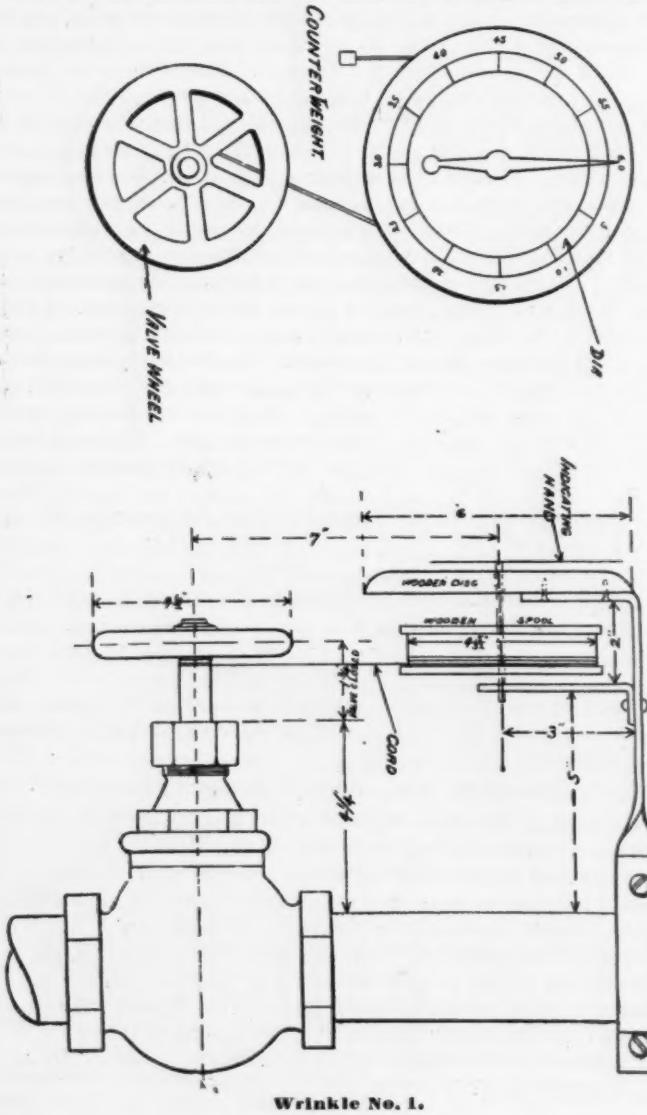
One circular letter was sent out to the members of all Gas Associations, and the Editor supplemented these by a personal letter to such members who, to his knowledge, were able to contribute. A number of very courteous responses were received, and the Editor feels reasonably gratified at the result.

I do not think the wrinkles this year show as much gradation into the higher classes as I would like to see, but I think the start has been made. I take this occasion to express my hearty thanks to the contributers for their efforts, and I wish to acknowledge my appreciation for the valuable assistance rendered by Mr. George S. Hessenbruch, Chief Draftsman, Laclede Gas Light Company, of St. Louis. I wish to call attention to the drawings accompanying these wrinkles, for which Mr. Hessenbruch is largely responsible, and I am free to state that he will gladly send a blueprint from the original tracing to any member who is particularly interested in any one point. The wrinkles have been classified as follows:

General; general construction; coal gas; water gas; chemicals; distribution; meter.

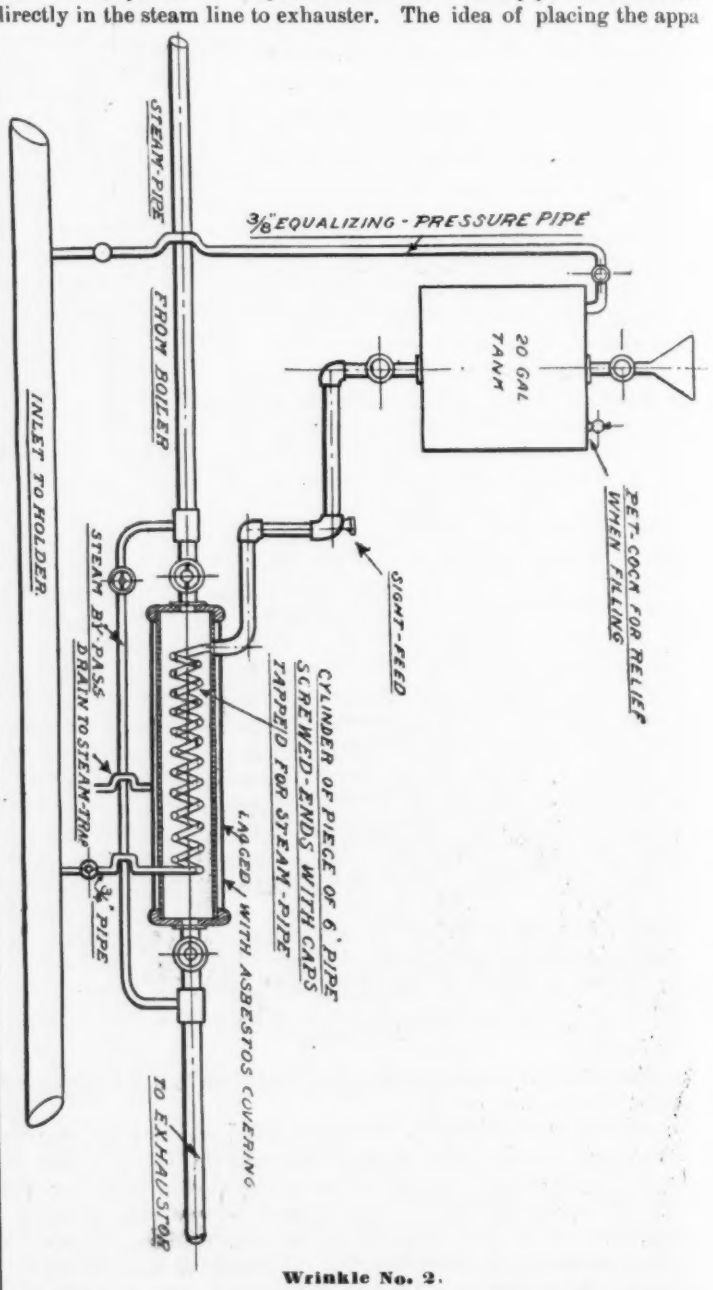
General.

No. 1.—"*Device for Indicating the Number of Turns that a Valve is Opened.*—As will be seen from the accompanying sketch, a cord is attached to the stem of the valve, and thence runs over a small drum around which it is wound several times, and having a small counterweight on the free end of the cord. This drum communicates with an indicating hand which registers the number of turns that the valve is opened on a dial. When the valve is opened the stem turns and winds up the cord, turning the drum and moving the indicating hand."—G. D. Fisher, Supt. Station B, Laclede Gas Light Company, St. Louis.



Wrinkle No. 1.

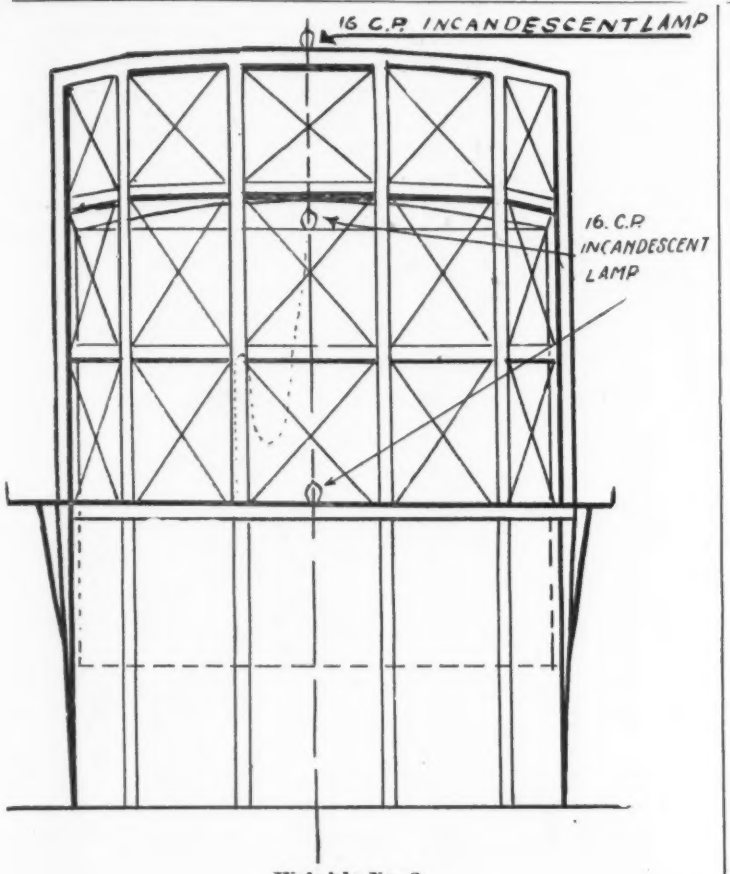
No. 2.—"*Method of Rigging up a Gasoline or Naphtha Vaporizer in a Small Works.*—The writer fitted up one with an old gas water heater coil, placed in a cylinder made of 6-inch pipe and connected directly in the steam line to exhauster. The idea of placing the apparatus in steam line to exhauster is to get the best results from the heat of steam and at the same time use as little as possible. The scheme works very satisfactorily when used with a sightfeed and can be operated continuously."—S. R. Walker, Laclede Gas Light Company, St. Louis.



Wrinkle No. 2.

No. 3.—"*Device for Observing the Height of a Relief Holder at Night.*—At Station A, Laclede Gas Light Company, the relief holder for water gas is small when the capacity of the plant is considered. The capacity of the water gas plant is 8,500,000 cubic feet per 24 hours, and the capacity of the relief holder is 150,000 cubic feet. The holder moves up rapidly at times and is in danger of blowing unless carefully watched. The exhauster is located some 200 feet away; so to keep watch on the height at any time during the night the following device was installed:

"An incandescent lamp was placed on the top strut of the guide framing, which shows the height to which it is safe to allow the holder to rise. Another lamp was placed at the curb line of the inner lift, which, of course, goes up and down with the inner lift, and a third lamp on the edge of the walk-around. The relative position of the



Wrinkle No. 3.

3 lamps shows the engineer at a glance whether or not the holder is in danger of blowing or landing. The accompanying sketch illustrates the scheme."—GEO. B. EVANS, Laclede Gas Light Co., St. Louis.

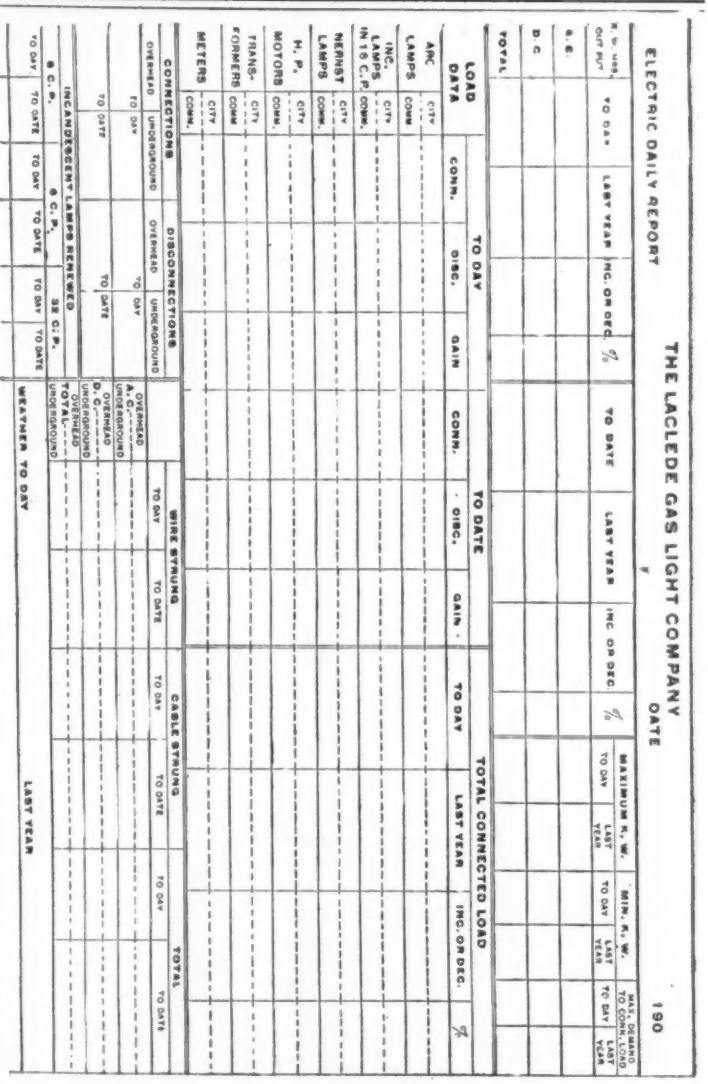
No. 4.—"*Data Card for Electric Department.*—The card shown is self-explanatory. Anyone taking the trouble to examine this card closely will find that one is able to put a large amount of information and data into a very small space. This card is filled out daily and shows an absolute record, giving a good oversight over the whole department."—A. N. GREEN, Laclede Gas Light Co., St. Louis.

No. 5.—"*Erasing Machine.*—In a drafting room where certain records have to be kept, such as street records, plat-books, insurance books, main records, etc., and where these records continuously change on account of new pipes being laid in place of the old ones, there will undoubtedly be a great deal of erasing done. To eliminate the large amount of time and work necessitated in erasing by hand, and to do the work carefully, a scheme was devised to do this erasing mechanically. The scheme is as follows:

"An ordinary dental engine, or machine that is used by dentists for drilling teeth, was procured, and a circular ink eraser set in the mandrel by means of a small screw instead of the regular drill used by the dentist. Everybody is familiar enough with the working of a dental engine without going into a general description of the same. Foot power is used, as is now mostly used by dentists, but a small electric motor could be easily attached and drive the machine without much cost. The flexible shaft to which the eraser and handle are attached allows considerable movement, and all the draftsman has to do is to guide the eraser by means of the handle. Anyone trying this machine will have to watch the following points:

"Keep the machine at a good speed and do not press the eraser hard on to the paper, as the machine erases very rapidly. It will be found that a good paper will take on a hard surface at the erased place, and that the erasing will hardly be noticeable. Erasing can be done by the machine in about one-tenth of the time it would take to do it by hand; besides it is not tiring to the draftsman. It will be found that the draftsman becomes very expert with it and can erase very fast, and when coming to a fine cross line can neatly jump this line without touching it, and at the same time eradicating the line he is working on completely."—G. S. HESSENBRUCH, Laclede Gas Light Company, St. Louis.

No. 6.—"*Oiling an Engine Cylinder.*—A good method of introducing oil into the cylinder of an engine may be had by arranging a continuous oil-feed, as shown in the diagram. A tank holding a barrel of

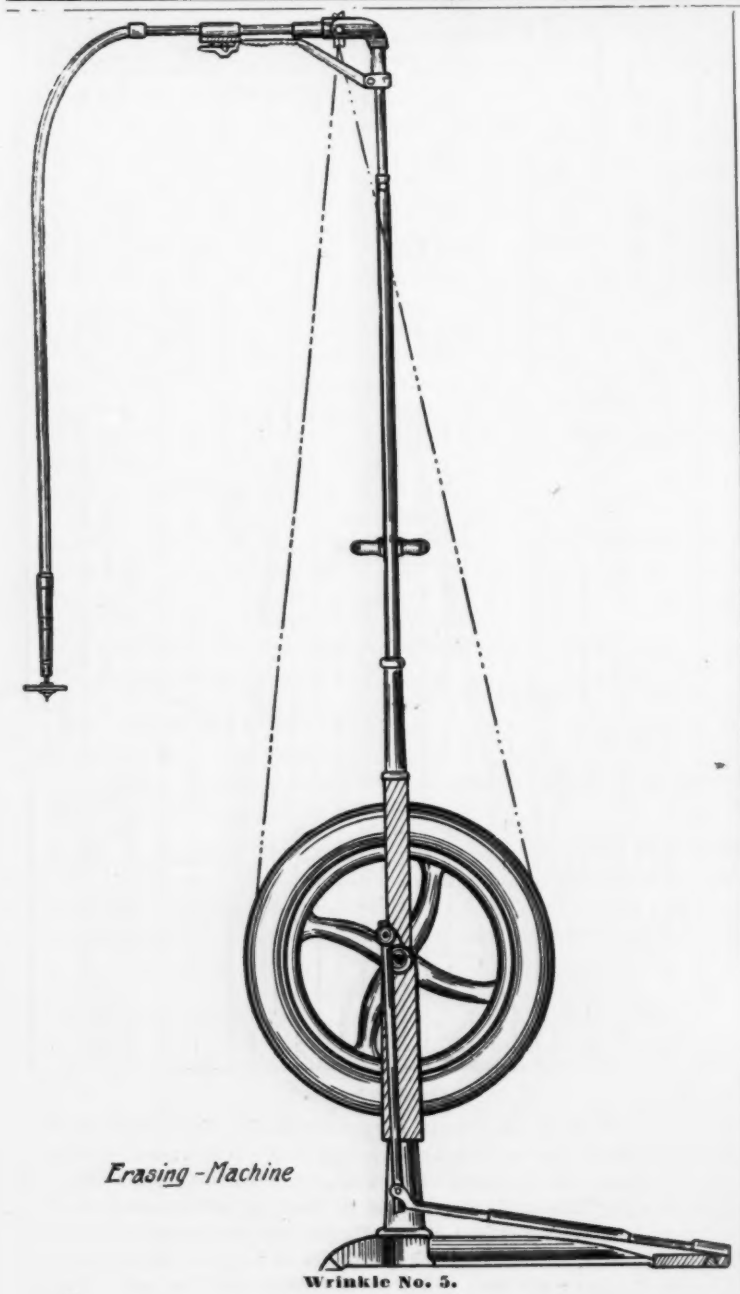


Wrinkle No. 4.

oil is placed in some convenient corner and a pipe *B* is connected from the main steam line to the tank, entering at the bottom with a valve *C* near the tank. By the condensation of steam in this pipe, a sufficient head of water is formed to make the oil flow out of the tank through a small oil line to a sight-feed *S*, and thence into the steam engine inlet. To fill the tank, a small rotary hand pump is used and is connected to a valve *D*, after a pet cock *E* has been opened and the water drained from the tank by a valve *F*. A glass gauge is placed near the top of the tank to tell when it is empty."—D. MACARTHUR, Laclede Gas Light Co., St. Louis.

No. 7.—"*Oxide Elevator and Trolley.*—The oxide elevator, as seen from the accompanying cut, is on the style of a man trolley and has two motors, one for propelling along the track and one for hoisting. The hopper itself has a dumping bottom."—J. D. SHATTUCK, Chester, Pa.

No. 8.—"*Blue Printing Machine.*—The attached photograph shows blue printing machine made by Mr. V. Chartener, Pittsburgh, Pa. The light used for printing is electric. The apparatus consists of a sliding table running on wheels on a track and is moved forward and backward whenever tracings are to be inserted, and also a glass frame which rests on the sliding table during printing. The tracings to be printed are laid on this table with a paper underneath the tracings; the table is then moved under the glass and is raised by means of bevel gears which work eccentrics inside of the rolling wheels of the table. As the table raises it comes in contact with the glass and frame, and raises this glass and frame from its supports, letting the whole weight of the glass and frame bear on the table and in this manner assures a splendid contact. The glass and frame are covered by a stationary hood in which the arc lamps hang. The shape of this hood is such that the rays of light are reflected so that no shadows are thrown, and the intensity of the light is practically the same at all points on the glass. The inside of this hood is painted with aluminum paint, white enamel being found to give too strong a reflection. A print is made in 4 to 5 minutes. The machine shown can take a print 5 feet by 10 feet, and is the largest size made. They can be procured in any size, however.



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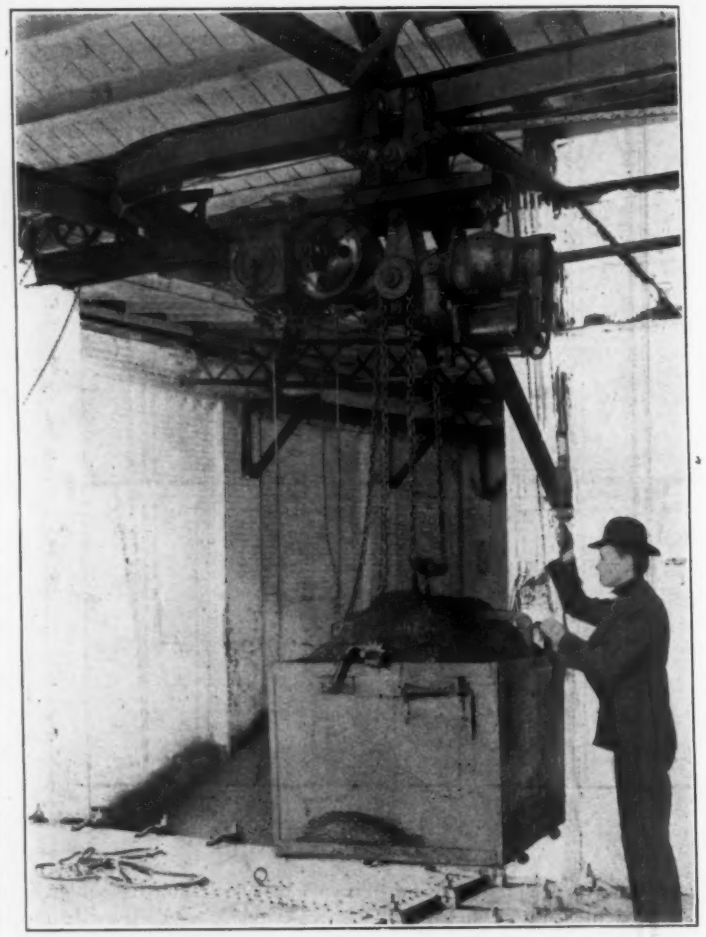

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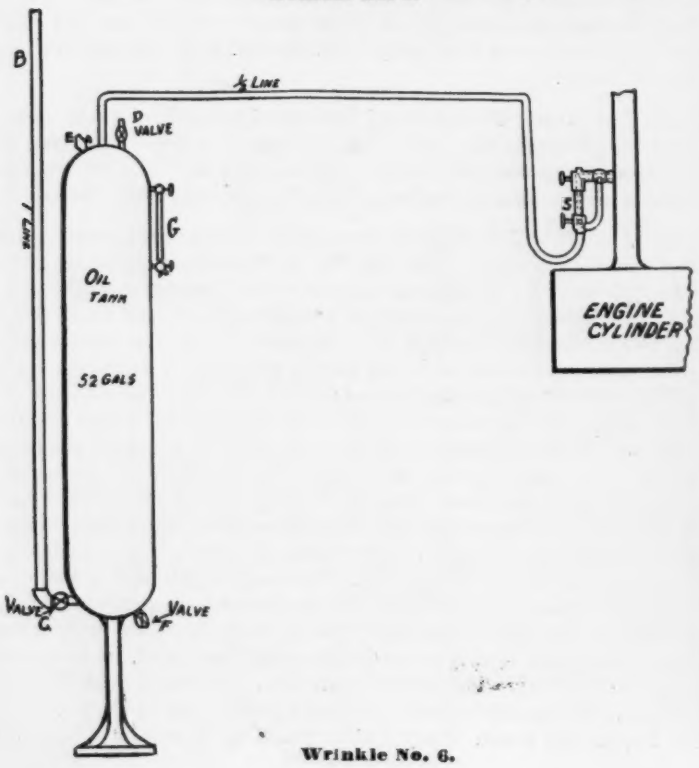
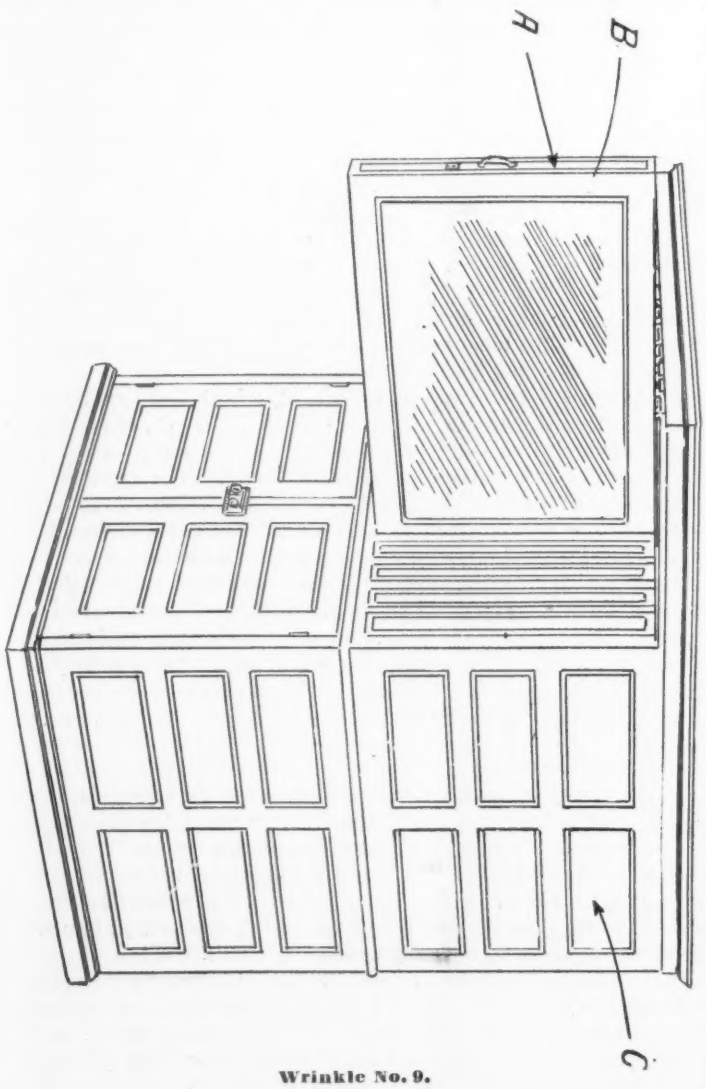


Wrinkle No. 6.

Wrinkle No. 8.

The Laclede Gas Light Company uses such a machine."—G. S. HESSENBRUCH, Laclede Gas Light Company, St. Louis.

No. 9. "*Map Case for Sectional Maps.*—The Laclede Gas Light Company uses maps which represent a section of the city, for recording the main pipes in the streets. To make it handy to inspect these maps without getting them too soiled, a cabinet was constructed, as shown on attached sketch. *B* shows a double frame with glass on each side. This frame slides back into the cabinet *C*. *A* is the board on which the map



Wrinkle No. 9.

is mounted, and which slides into the frame *B*, showing a section of the city on each side of the frame, which map is protected by a plate glass. The board *A* on which the maps are mounted is locked into the frame *B*. These maps are posted every week."—GEO. HESSENBRUCH, Laclede Gas Light Co., St. Louis.

No. 10.—"*To Prevent Lead Poisoning.*—The attached card is self-explanatory, and it is a good thing to have plenty of these cards posted around the works where the men can see them and act according to the instructions given on this card."

LEAD POISONING.

1st. Wipe off all FRESH PAINT, or RED LEAD with waste before blowing into pipes.
2d. Don't get RED LEAD mixed with your CHEWING TOBACCO.
3d. Wash LEAD and PAINT off your hands before eating.
4th. RED LEAD and FRESH PAINT are slowly absorbed into the system from small quantities or stains gotten on the lips or into the mouth. This lead may do no apparent damage for MONTHS, when it will suddenly cause the severe pains characteristic of LEAD POISONING or may cause LEAD PALSY.

G. W. WHITFIELD, M.D.

No. 11.—"*Burning off Mantles.*—To burn off mantles and clean the carbon from tips, I use oxygen gas. I impinge it on the mantle or tip through a fine nozzle after the manner of a hand-blow torch. It greatly improves the Welsbach service, is quick and does not injure the mantle."—M. NISBET LATTA, Charlotte, N. C.

(To be Continued.)

Bristol's New Recording Voltmeter for both Direct and Alternating Current.

The importance of maintaining uniform voltage in the generation and distribution of electricity for light and power has long been appreciated by both the producer and the consumer.

A variation of comparatively a small percentage in the voltage of an incandescent lighting circuit from the standard for which the lamps are designed causes great loss in the life of the lamps and results in wide fluctuations in the efficiency and candle power. In the application of electric power, as for instance on an electric railway, it is of great importance that the voltage be maintained regardless of the variations in the load.

The recording voltmeter has proven itself to be of great value, and is an indispensable part of a modern electric plant, since it accurately, automatically and continnously furnishes a written record of the slightest variation of the voltage. The recording voltmeters manufactured by the Bristol Company, of Waterbury, Conn., have been extensively adopted, but up to the present it has been necessary to furnish the instruments with entirely different current coils, according as they were to be employed upon alternating or direct current circuits.

In many electric plants both alternating and direct current are generated, and if the same voltmeter can be used equally well for recording either kind of current, it is quite evident that a valuable advance has been made.

This has been accomplished, and Fig. 1 illustrates the standard station

Fig. 1.

or switchboard design; in Fig. 2 a special portable form of the instrument is shown. The case is provided with a handle and leveling screws for convenient transportation and adjustment. The door is open, showing the construction and manner of operation.

The novel features and improvements to this new voltmeter are: First, it is equally applicable to both alternating or direct circuit; second, it requires only one-third as much current to operate as that necessary for the older design for alternating currents; third, it is more sensitive to very slight variations of voltage; fourth, the chart graduations are nearly uniform on both sides of the working range; fifth, the portable form of the instrument in its carrying case is only half the size and weight formerly required.

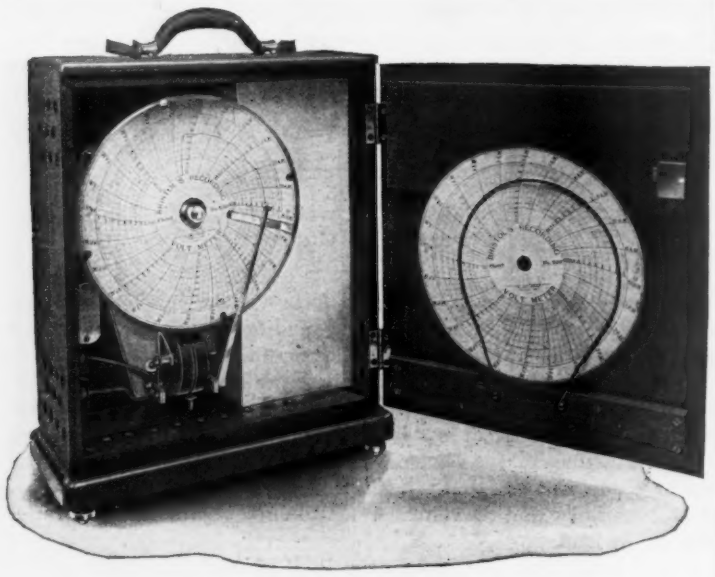


Fig. 2.

The solenoids shown in Fig. 2 are connected so that when current is passing through them in series the movable solenoid will be repelled from, instead of being attracted toward, the stationary one.

The movable solenoid is mounted on a frictionless knife-edge, multiplying device, which transmits its motion to the pen arm carried by the knife-edge blade.

This simple multiplying device permits the solenoids to be located very near each other, and consequently the magnetic field of force is uniform throughout, the motion of the solenoid resulting in the desirable scale divisions of the chart.

By making the constructions of the solenoids so that there is repulsion instead of attraction, the mutual inductance between them is neutralized, thus making the same instrument suitable for recording either alternating or direct current. The instrument is independent of the rate of alternations and is compensated for changes of atmospheric temperature.

(Concluded from Page 931.)

Notes on the Use of Rare Earths in Electric Illuminants.

By Murray Charles Beebe, in *Jour. Am. Chem. Soc.*

In connection with these speculations as to the real nature of the process by which the current traverses the glower, it is a fact that glowers which have operated for even a short time upon direct current will, when the current strength is diminished sufficiently to maintain the glower at only a good red heat, explode with considerable violence. This may be accounted for by considering that the conductivity at low temperatures is insufficient to ionize the surrounding and contained gases. The means of conducting the current then being largely electrolytic in character, the combination of the products of electrolytic decomposition cannot so readily take place, since the ions cannot so readily traverse the length of the glower to combine at the lower temperature, and consequently disruption occurs.

The suggestion that has so often been made, namely, that the current be reversed in direction at intervals, as, for instance, every time the lamp is started, is altogether impracticable for the reason that a glower once operated upon direct current must never have its poles reversed, for a reversal means almost instant disruption. The potential difference across the terminals of the glower immediately after such a reversal is lower, indicating something analogous to polarization effects as we know them in aqueous electrolytes.

In general, with the Nernst terminal the potential difference across the glower at the normal current value is the same with alternating or direct current. With the Hanks terminal, or imbedded type, the potential difference with direct current may be as much as 20 volts lower. The Hanks terminal will operate on direct current, but not satisfactorily as a commercial proposition. The life of the alternating current glowers is greater upon high frequencies than upon low frequencies, again suggesting electrolytic conductivity, at least in part.

The small glowers, up to 0.5 ampere, are made solid in cross-section, the larger ones are generally made tubular, and, in fact, 1-ampere glowers must be made so. The reason for this is not that greater efficiency is sought by increasing the ratio of surface to volume, which is, of course, a fallacy, but inasmuch as the glower possesses a decided negative temperature co efficient as regards electrical conductivity, the center of a large solid glower would become molten before the outside surface reached an efficient temperature, the center being the better conductor. Glowers which have been greatly overrun often exhibit this truth by the appearance of a nodule of molten material which has spurted out to the surface.

Glowers in Vacuum.—A glower will operate in vacuum but the vacuum rapidly deteriorates, as before stated. A blue aurora or luminous haze surrounds the glower thus operated, either with direct or alternating current, and has been thought to be due in some way to vaporized metal (zirconium or yttrium) recombining with the slight amount of oxygen liberated. This idea seems plausible from the fact that objects, such as wire or glass, near the glower become coated with a white deposit of the glower oxides in a comparatively short time.

It would seem that oxygen necessarily plays a part in conducting the current, for a glower in an atmosphere of hydrogen or nitrogen behaves similarly to the one operated in a vacuum. In carbon monoxide or dioxide the glower exhibits the same characteristics as in air. The glower operated in vacuum exhibits a peculiar sluggishness in responding to changes in voltage at its terminals.

A commercial glower must operate at a high temperature to be efficient. Nernst glowers operate at about 2,300° C., it is supposed from determinations made by photometric means and at about twice the efficiency of a carbon incandescent lamp. The spectrum of a glower is a continuous one and no evidences of selective emission in any particular region are noted. During the life of a glower, which averages about 800 hours under normal conditions of manufacture and voltage regulation, a depreciation of candle power takes place, due to a number of causes. In the first place, all oxides of the rare earths do depreciate rather rapidly in light intensity per unit of surface at any given temperature. This is true even when heated by gas or electricity, and a platinum plate coated on one side with rare earths and heated from the rear by an oxyhydrogen flame behaves similarly. It is an inherent property of these oxides and a depreciation of 10 or 20 per cent. may occur during the first hour. There is then a slow diminution of intensity of light, also inherent, and seemingly accompanying the tendency of the glower to change from an amorphous to a crystalline structure. A rise of potential difference across the glower terminals is usual, though it is possible to counteract this tendency, at least in part. The effect of a rise in potential difference, obviously, is to diminish the intensity of light by permitting less current to traverse the glower running on a constant potential circuit.

With carbon incandescent lamps the useful life or smashing point is considered to be that number of lamp hours during which the candle power decreases 20 per cent. from the initial candle power. Nernst lamps are similarly rated, counting as initial candle power that measured after the initial decrease above mentioned.

Another cause of depreciation in candle power is blackening of the inclosing glassware and reflecting surfaces. In this connection the blackening is due largely to platinum which has been vaporized and deposited upon these surfaces. It has been found that the purest platinum is far better than that containing iridium or other of the platinum group, since pure platinum vaporizes much more slowly than alloys with these other metals.

It is to produce uniform chemicals and glowers in which the tendency to depreciate in light intensity and increase in potential difference shall be a minimum that makes the problem so intricate and so fascinating and still capable of much improvement.

Curiously enough not the least of the problems to be solved in the development of the Nernst lamp was to overcome the tendency of porcelains to conduct electricity, the very property which in the case of the rare earths made such a lamp as the Nernst possible. A heater is necessary to start the glower. The heater is made by winding fine platinum wire upon a porcelain tube. It was necessary to produce a suitable porcelain which would withstand the high temperatures required and at the same time not conduct electricity, A porcelain composed of kaolin, alumina and silica is sufficiently refractory and porous to withstand the heat and is an almost perfect non-conductor at high temperaiures. The porcelain piece upon which the glowers and heaters are mounted is also of the same composition.

Another form of heater, used more abroad than in this country, is helical in shape, and the glower is mounted in its axis. This is made of pure kaolin, and after squirting into tubes about a millimeter in

diameter, winding with fine platinum wire and covering over the wire with a paste, the small tube is bent into a helix upon a mandrel, a pointed blowpipe flame playing upon the kaolin tube at the point where it bends on to the mandrel.

Possibilities of Self-Starting Filaments.—Many oxides will conduct at room temperature. A mixture of iron and tin oxides, about 70 iron to 30 tin, will start without preliminary heating and withstand rather a high temperature. There are many other similar combinations, likewise other possibilities exist, such as carbides, silicides and borides, operated either in vacuum or gases.

A Nernst glower may be made to conduct the current at low temperatures by running it for a short time in a rarefied atmosphere containing a carbon gas. If to a globe in which a glower is operating in a good vacuum an amount of hydrccarbon gas is admitted sufficient to lower the vacuum even less than a millimeter, the potential difference across the terminals of the glower will decrease rather rapidly, and in the space of a few minutes or even seconds the glower will have become a conductor when cold or, in other words, self-starting.

The following experiment was tried:

A glower was mounted in a glass bulb and in the axis of a carbon filament of helical shape. The bulb was well exhausted and sealed off. The carbon filrment was used 4 or 5 times to start the glower, alternat ing current being employed. After the glower had run a few hours it was noted that it was changing color at its terminals. The discoloration gradually crept toward the center and after about 24 hours the glower could then be started without preliminary heating. Apparently enough of the carbon filament was oxidized during the short time it was in use to give a slight quantity of free carbon monoxide in the bulb, the source of oxygen being the glower itself.

It is uncertain whether this gas was effective in reducing some of the glower material to its metallic form, or whether a conducting carbide was formed by the action of the carbon gas upon the glower materials.

The former explanation seems preferable for the reason that it was noticed that the darkened portion at the negative end of direct current glowers is of higher conductivity than the glower proper, and it seems quite likely that this deposit is a metal separated out by electrolytic action. Metallic zirconium, for example, withstands very high temperatures in the open air without oxidizing, and its melting and vaporizing points where air is excluded must be very high.

Many possibilities exist, such as are suggested by the above experiments, and many of them have been tried. Boron carbide, for example, withstands very high temperatures and is a conductor while cold, though it seems to vaporize somewhat too rapidly; at least this was the case with samples tried, which probably were not very pure.

A Nernst glower, as well as those composed of thoria, magnesia, and almost any of the refractory oxides, may be made conducting by treatment with a hydrocarbon gas. Sodium and potassium vapor also affect a reduction to the self-starting condition, though not generally so readily as carbon.

There is a broad field still open and much that is not known of the properties of the rare metals. Oftener than not the supposedly pure metal is very impure, and the properties generally ascribed to it are in reality those of its carbide or other little known combination. Note the difference in properties of pure iron and iron containing even less than 1 per cent. of carbon. Is it not a fact then that almost nothing is known of the physical properties of the rare metals? A good example of this point, and one bearing directly on our subject, is the recently developed tantalum lamp, the filament of which is a fine thread of tantalum metal. Tantalum metal, until recently, was not known to possess properties which now make it a promising addition to electric illuminants.

More or less experimental work has been done, particularly in Europe, in using the rare earths in electric arcs with the idea of obtaining better efficiency and more pleasing light. Lamps have even been tried with electrodes composed entirely of the rare earth oxides, though at the present time the greatest advances in arc lighting are being made along the lines of introducing such elements as boron and titanium into the electrodes.

THE election of officers for the reorganized Winona (Minn.) Gas Company, which was held in Cleveland, O., some days ago, resulted in the following choices: President, W. B. Parsons; Vice-President, H. A. Mann; Secretary, C. A. Fitzgerald; Treasurer, F. L. Fuller.

The Tantalum Incandescent Lamp.

By DR. LOUIS BELL.

A fortnight or so ago the author told of the test of some 25-hefner, 110-volt tantalum lamps by himself and Prof. W. L. Puffer, two of the lamps being tested for decay and reported in detail recently in *Elec. World.* The light of the tantalum lamp is, as might be expected from its high efficiency, rather whiter than that of an ordinary incandescent, being as white as the Nernst lamp or the acetylene flame. Its distribution of light is in the present form of filament rather less uniform than that of the common incandescent lamp, being relatively more powerful in a horizontal zone and less powerful for points near the axis. The ratio of mean spherical to mean horizontal candle power, as found in Prof. Kennedy's investigation of the frosted lamps, proved to be .73, and Dr. Bell's figure from the clear lamps was substantially the same. The distribution, however, could very easily be improved, so that the spherical reduction factor would not differ materially from the usual figures and the light at the top could be correspondingly increased.

Since the tantalum filament has a low initial resistance (between 55 and 60 ohms) it jumps into incandescence with startling rapidity as compared with a carbon filament, but because of its positive temperature coefficient it seems to be decidedly less sensitive to changes of voltage in its working condition, This is a useful property in certain respects. The fact, however, that the initial resistance of the tantalum is so low and its thermal inertia so small owing to its small mass and low specific heat, means rather violent heating up, which is probably the cause of some doubts which have been expressed as to the endurance of these lamps upon alternating circuits. It is not difficult to imagine pretty severe strains upon the filament if it had time to cool down much between impulses. If such cooling could take place, for instance, on an ordinary alternating circuit, the results might be serious.

Some stroboscopic tests were, therefore, made at the last moment to determine whether at, say, 25 cycles, there was a specially violent fluctuation of light from the tantalum lamp; in other words, to find out whether on a 25-cycle current the filament had time to cool down materially. The result showed that the light fluctuation at this frequency was somewhat but not much more pronounced than in a carbon filament. The tantalum lamp behaved in fact about like a 16-candle power carbon filament lamp. Even a 75-candle power carbon filament lamp, however, shows perceptible variation under this test. At 60 cycles the fluctuation, while still perceptible, was trivial both in the tantalum and carbon lamps. It hardly seems probable that at 60 cycles the life of the tantalum would be enough impaired to cause serious trouble, but the writer now has some lamps on alternating current tests and proposes to pursue the inquiry.

The tantalum filament seems to stretch and sag at first as if undergoing annealing and losing the set produced by drawing. Then it shows local bright spots which grow lumpy as if the material tended to flow a little from the heat, and with the increasing lumpiness the filament draws up tight. At this stage it is rather fragile and would probably break easily from vibration or shock. It seems likely that the final break comes just where one of the lumps has reduced the cross-section of the wire beside it. The break in the lamp during test already referred to showed considerable attenuation of the loose end.

The lamps as tested showed the following characteristics:

Lamp.	Watts.	Candle Power.	Watts per Candle.
Clear Globes.....	41.58	21.42	1.94
	38.61	20.90	1.84
	41-58	24.93	1.66
	41.58	21.55	1.93
	41.91	21.81	1.92
	41.91	22.59	1.85
Frosted Globes.....	40.36	19.79	2.03
	40.34	18 54	2 15
	40.04	18.74	2.13
	40.48	19.27	2.09

The mean result from the clear globes was 22.2-candle power at 1.85 watts per candle power; that from the frosted globes 19.08-candle power at 2.1 watts per candle.

It is interesting to note that the clear lamp gives just about 1-candle power per inch of incandescent filament, which implies an intrinsic brilliancy of somewhere about 500-candle power per square inch of filament—a figure much higher than in the ordinary incandescent.

As illuminants the lamps are certainly very excellent, but their introduction raises some most interesting questions for the central station operator. Putting aside all the petty questions that will be

raised about the new lamp for commercial reasons, the broad fact remains that we are here dealing with a bona-fide 2-watt lamp having a life fairly comparable with the carbon filament lamps now customarily in use. Moreover, it is a competitor of these, socket by socket and not as a substitute with particular requirements as in the case of the Nernst lamp, or the very small arcs. There is some doubt as to the life of the tantalum lamp when exposed to unusual vibration, which may perhaps bar it in some special locations, but for the everyday work of the central station there is a good reason to believe it generally applicable.

Its price can hardly be said to be fixed in this country, but abroad in Berlin it is about $1 (4 marks), which will give at least a fair line on its commercial results. On this basis and with power at 10 cents per kw hour, one finds taking the new lamp on its 600-hour rating that the cost of its 12,000-candle hours, including the lamp, amounts to $3.40. The same number of candle hours from a lamp giving a mean efficiency of 3.25 watts per candle would cost $3.90, exclusive of lamps; that is, the consumer could afford to pay $1 for the new lamp better than to take the old ones free. With power as low as 5 cents per kw-hour, the user of tantalum lamps could afford to pay only 75 cents per lamp as against getting carbon lamps free. This means that a sliding scale of discounts for lamps according to quality could be made to catch the consumer at all prices ordinarily charged for current by central stations.

Does this mean that the carbon lamp will shortly be down and out? Probably not, for there is no spur like competition to start up improvements, and there are some signs that carbon lamps may be improved enough in efficiency to make things interesting, at least with current at the prices charged to very large consumers. This, however, remains to be seen, and the thing which the central station man has to meet is the immediate probability of consumers putting upon their circuits lamps taking less than two-thirds the watts per candle power of the best lamps now in use, and thereby cutting down their meter bills enormously. Now, broadly, what shall be the attitude of the central station man toward this income scalping innovation? There are some managers who may be inclined to put up a fight to discourage the user, either by raising pettifogging objections or by trying to discriminate against 2-watt lamps by readjusting discounts in various ingenious ways. Dr. Bell is very strongly of the opinion that such a policy is wrong and will certainly lead to ultimate disaster in the form of municipal restrictions or regulation of rates by law. In the long run, opposition to improvements does not pay. If, on the other hand, the central station man hangs quietly on and gives the consumer the glad hand, the change will work to his ultimate benefit. In the first place, the tantalum lamps now made are of 22-candle power instead of 16, and the filament will hardly bear much reduction in cross section. The tendency, therefore, will be to use these slightly more powerful lamps taking, say, 42 watts instead of a trifle over 50 watts in the 16-candle power lamps. The actual loss in energy sold is likely, therefore, to be for the present quite a little less than the difference of efficiency would indicate.

Besides this, the attraction of cheaper light will certainly bring into line new consumers, so that the net result will probably be an actual increase in sales of current, quite a little of it being among the smaller consumers who pay the higher rates. Such a change means upon the whole more lights connected per unit of capacity in transformers or feeders, and hence a slightly better utilization of material and improved load. In the case of stations with underground service, the change to 2-watt lamps ought to bring with it increased earnings per unit of cable capacity. The fact is that improvements in the efficiency of utilization of electric energy help the business, and it is both fruitless and inadvisable to oppose them from any shortsighted notion of small temporary savings.

As to the inevitable competition between present lamps and the newcomer, in the first place, the merits of the final issue remain to be determined, and in the second place competition in lamps is, on the whole, a good thing for the user of them, however it turns out. So far as the central station is concerned, it is a case of dog eat dog.

The really important thing is that from now on the station manager will have to deal directly with the 2-watt lamp proposition, for there is no disguising the fact that it is here, and in a form which is quite unexpected. The appearance of tantalum lamps in quantity may be a little delayed in this country, but delay will improve them as in the case of every new product, and will serve to assure a better understanding of their truly remarkable properties and of their possible limitations. The unexpected has certainly happened, for most engineers had long ago abandoned the idea of a lamp with a metallic filament. Only the discovery of a metal virtually new, and possessed of most sensational qualities, could have brought about the present striking result.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. Frank Lane, whose resignation as Superintendent of the Fishkill and Matteawan (N. Y.) Gas Company, in order that he might accept the post of Superintendent of the Altoona (Pa.) Lighting Company, has heretofore been reported in the Journal, has been succeeded at Fishkill by Mr. Henry Loiselle.

The United Gas Improvement Company has recently been awarded a contract by the Laclede Gas Light Company, St. Louis, Mo., for two sets of its double-superheater, Lowe water apparatus, having a daily capacity of about 4,000,000 cubic feet. The U. G. I. also has underway at the present time contracts for 25 sets of its apparatus, having a total daily capacity of about 32,000,000 cubic feet. Among the places in which the apparatus will be installed are the following: Catasauqua, Pa.; Pottsville, Pa.; Lansdale, Pa.; Plattsmouth, Neb.; Detroit, Mich.; Springfield, Ills.; Oneonta, N. Y.; Evansville, Ind., Hempstead, L. I.; New Britain, Conn.; Sioux City, Ia.; Amsterdam, New York City; Mutual, New York City.

Mr. R. S. Greenwood, of the Pueblo (Col.) Gas and Fuel Company, writing under date of June 5th, says:

To the Editors American Gas Light Journal: I would like to give my opinion along with many others in regard to methods followed by different companies as to their means of securing new business. The general opinion prevailing seems to point to the solicitor; or, in other words, the success of the company is dependent upon the solicitor to no small degree. If this is true, we would have to consider the position held by the solicitor one of the utmost importance. Is it considered so? Is is not a fact that as a rule they are picked up and put to work at any and all times without any, or very little, consideration upon the part of the employer? The man wants a job, the gas company wants a solicitor, the deal is closed and the man is instructed to bring in the business. Nine times out of 10 the man can't sell $5 gold pieces for 30 cents. The result is, the solicitor becomes discouraged, the gas manager gets angry and impatient, and, after 30 days of dissatisfaction and unfriendly feeling between the employer and employee, the new man gets presented with a discharge check, and there is an opening for another man. Has anything been accomplished? No; both parties have been injured Why not take more time, investigate the man thoroughly, make him produce the best of reference, find out if he is the man you are looking for and if he has any business ideas of his own that would allow him to use his judgment in case of emergency to the advantage of the company. Do not call your representative a solicitor. There are already too many, and people are tired of hearing the name, and the man himself might feel a little embarrassed to be classed with the book or lightning rod soliciior. Why not obtain the services of a good, all-around business man, one who is able, capable and always willing to do anything for the interest of your business? He should be on friendly terms with all the consumers, see them as often as possible, give prompt attention to their kicks, see that they are adjusted and the party made to feel satisfied before leaving him. This blocks your competitor's argument. The customer is not only pleased with his service, but he feels that the company's representative is a good fellow, and in many cases considers him a friend, because he has taken an interest in his troubles and proved that his patronage is appreciated. You have got to take care of the fellow already on the book, or the other fellow will. Gaining one customer and losing two looks a very poor way to advance. One good light customer nets more profit than 10 ranges. A business agent should be able to judge between a dead beat and one who pays. Will a man on commission give this due consideration before closing a deal? Pay him well for his work and he will stick. Changing men every little while is an injury to the company. Be free with your man and make him feel at home in your office or company. Give ideas that he may present in regard to new methods due attention, and if considered worthy try them. The man who is out among the customers all the time might tell the man in the office something he has overlooked. Give your representative instructions not to lose any old customers. Hold the old ones at all hazards; then with his spare time work for new ones. The representative should always be courteous, pleasant, and an all-round nice fellow with all classes. It is almost necessary for a man in this position to be an impersonator, ready to alter his ways without notice. Methods applied on one customer if used on his neighbor would only prove disastrous. Pay a good salary. Why? Well, a good man man will not work on a commission. Good men are scarce and they are not running around without employment very long. If he is not worth a salary "cann" him.

Otherwise he will catch you napping and have a service run into a house, 80 feet of pipe run from meter to stove under the free installment act. The woman burns about one dollar's worth of gas, sells the range that she has not paid for and leaves town. Why did he do this? Because he was a tramp solicitor, and the job netted him $3.60 commission.

DR. GEORGE REVAY, who attended the last meeting of the Iron and Steel Institute, London, England, is back at his quarters, 45 Cedar street, New York city, ready to talk business in his particular lines, which have to do with coking plants and the like.

ON June 8th the Interstate Commerce Commission rendered a decision in the case of the Capital City Gas Company, of Montpelier, Vt., against the Central Vermont Railway Company and the Rutland Railroad Company, the decision going to the complainants at all points. The hearing was had last September, and the result is of importance to almost every gas company in New England. The records in the case show that the carriers made a joint rate of 90 cents per ton on bituminous coal from Norwood, N. Y., to Montpelier, Vt., when intended for "railroad supply," and a combination rate of $1.86 per ton which applied on such coal carried between the same points but used for manufacturing or other industrial or domestic uses. The Commissioners, in quite decided terms, hold this practice constitutes unlawful discrimination.

AT the annual meeting of the shareholders in the old Reading (Pa.) Gas Company, the officers chosen were: Directors, Wm. R. McIlvain, Chas. Breneiser, Isaac Hiester, Jas. J. Kutz, Wm. D. Smith, Wm. McIlvain and Chas H. Schaeffer; President, W. R. McIlvain; Secretary and Treasurer, John H. Reilly.

THE Chippewa Gas Company, of Jamestown, N. Y., has been incorporated by Messrs. G. V. Blackstone, C. W. Sharp and John Gelm. It is capitalized in $30,000.

AT the annual meeting of the Georgetown (D. C.) Gas Light Company the officers elected were: Directors, M. J. Adler, S. T. Brown, Wm. A. Leetch, W. A. Mearns, Geo. L. Nicholson, William B. Orme and Robert D. Weaver. President, W. R. Deedle; Vice-President, M. J. Adler; Secretary and Treasurer, Frank P. Leetch; General Manager and Superintendent, Robert L. Middleton.

AMONG the contracts for plant betterment on the properties of the New York and Queens concern at Flushing, L. I., are the following: Purifiers to the Gas Machinery Company, Cleveland, O.; station meter, to the American Meter Company, N. Y.; boiler equipment to the Novelty Boiler Works, Greenpoint, N. Y.; and a 12-inch street governor to the Connelly Iron Sponge and Governor Company, N. Y.

MR. T. A. BATES has been appointed Superintendent of the gas division of the properties of the Davenport (Ia.) Gas and Electric Company, vice Mr. W. L. Bowers, resigned.

MR. THOMAS KEMP, of the "working force" of the American Coke and Gas Construction Company, has been transferred from Duluth, Minn., to Camden, N. J. The change should be welcomed by him.

MR. JAMES L. RICHARDS and Mr. Frank E. Smith, as President and Treasurer, respectively, of the Boston (Mass.) Consolidated Gas Company, have filed with the Board of Gas and Electric Light Commissioners the Company's acceptance of the new regulations. Under these the Company agrees that it will, within 12 months from the date of the acquisition by it of the property and franchises of ths several merged corporations, reduce the maximum price of gas to 90 cents per 1,000 cubic feet.

THE Lower Allen Illuminating Gas Company, to supply gas to the residents of Lower and Upper Allen townships, and the towns of New Cumberland and Shiremanstown, Cumberland county, Pa., has been organized by Avery P. Sickels, Frank P. Snodgrass and J. G. Diffenderfer. The initial capital was put at $5,000.

THE Massachusetts Board of Gas and Electric Light Commissioners, in dismissing the petition of the Edison Electric Light Company, of Brockton, Mass., for the right to increase its capital in the sum of $175,000, filed the following opinion:

"The Company has outstanding bonds of the par value of $100,000 and coupon notes of the par value of $75,000. These bonds were issued in 1900 and are due in 1930. The coupon notes were issued in 1901 and are due in 1921. Both bonds and notes bear interest at 5 per cent. By the terms of the trust deeds securing these issues, the bonds may be called after the first day of December next at 110 and the coupon notes on any interest day at 105. A tentative arrangement has been made for the immediate surrender of nearly all the bonds at 112. There was no claim of any special exigency in the Company's affairs requiring the payment of these obligations at the present time. They have many yaars yet to run and can be cancelled now only at a substantial premium. So far as the Board is aware, there have never been any sales of the stock of this Company above par. The dividends have never exceeded 5 per cent, and there is no evidence that this rate is to be increased in the immediate future. Taking into account previous sales and other pertinent conditions, it is doubtful if the Board would be justified in fixing a premium upon an issue of shares at this time. If the Company's condition shall be improved so as to permit in the future an increase of the dividend rate, the stock will naturally advance in price. There is an evident private advantage to the shareholders in the immediate conversion of these bonds and notes into stock. There is equal reason to believe that the public interest will be conserved by allowing them to remain in their present form for a larger portion of their original term. Under these conditions the issue of the proposed stock at the present time does not seem to be reasonably necessary for the purposes for which the corporation is authorized to issue stock and it is voted to dismiss the petition."

MR. F. C. TIDHAM, of Dallas, Tex., has been appointed General Manager of the Oklahoma City (Okla) Gas and Electric Company, vice Mr. T. K. Jackson, resigned. Mr. Jackson takes up a responsible position with the Byllesby Engineering Company, of Chicago.

MR. JOSEPH JACOBS has been appointed receiver for the properties of the Winston-Salem Gas and Lighting Company, of Winston, N. C.

No one appeared before the Board of Gas and Electric Light Commissioners in opposition last Tuesday to the petition of the Natick (Mass.) Gas Light Company for the right to issue additional capital in the sum of $25,000 par value.

A MOVEMENT, backed by men who mean business and have the money as well, is underway for the establishing of a gas plant at Needham, Mass. Prominent in the scheme are the Messrs. Goldthwait, Shaw and Alden.

The Peat Industry.

Electricity notes that in view of the fact that coal is becoming scarcer and consequently higher in price each year, and that the time may come when other means of generating power will have to be sought for, a few words regarding the peat industry in this country will not be amiss.

As yet this industry is in its infancy. A few small operations are now going on, however, and a great number of prospective schemes are being exploited.

Several companies have been organized in the Middle and Northwestern States to produce peat fuel by various methods.

Some of these are building plants to operate during the summer of 1905. Others do not seem to have advanced beyond the prospectus stage. Many of these promise extraordinary profits by the use of patented processes, often involving the use at some stage of electrical devices.

Besides various plants in Canada and Mexico, mention is made of certain plants in the United States. The Pompton Fuel Developing Company is producing machine peat near Lincoln Park, N. J., and sells all its product to local consumers. Its success on a small scale will probably result in building a much larger plant this year. The machinery in use was imported from Germany and includes a Dolberg breaker and mixer. This company controls a large acreage of peat land in the vicinity of Pompton Plains, N. J. Another plant is in operation near New Rochelle, N. Y., by the Peat Koal Company, of New York, which uses a Schlickeysen machine. At Orlando, Fla., machine peat is manufactured on a machine designed by Mr. T. H. Leavitt, of Boston. A company has been organized in California to manufacture briquettes composed of peat and oil. Some tons of fuel have been made and satisfactorily tested, both for domestic and steam raising purposes.

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The Market for Gas Securities.

The situation in the city gas share market is quite like that of a week ago, barring perhaps an exhibition the last 6 market days of an inclination towards better or higher prices. Consolidated shows an advance of about a point, and when some of the "real things" at Albany begin to take their profit on the short side of the trading of a month or so ago, the advance should carry the stock well beyond 190. The closing in it to-day was 186 to 188. There is a fair demand for city gas bonds.

Brooklyn Union is at normal figures—180 to 195—which disparity certainly affords a chance for buyers to agree on "a price." Peoples of Chicago, is 101⅜ to 101½, and Washington (D.C.) is unchanged. There is some more talk about Philadelphia capitalists looking towards a purchase of Cincinnati Gas and Electric but our belief is that the present control will control it for some time longer.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JUNE 19.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	186	188
Central Union, Bonds, 5's	3,000,000	1,000	108½	110
Equitable Bonds, 6's	1,000,000	1,000	..	109
" 1st Con. 5's	2,300,000	1,000	118	120
Mutual	3,500,000	100	300	330
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	112	113¼
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	35	..
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	..	..
Northern Union, Bonds, 5's	1,250,000	1,000	104	106
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	112	114
" 1st Con. 5's	1,500,000	..	106½	108½
Standard	5,000,000	100	125	130
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	180	195
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	¼	⅜
" ncome Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	6	7
" " Bonds, 5's	5,250,000	1,000	66	68¼
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	107¾	108
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	97½	99
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¼	89¼
Preferred	3,026,500	100	107½	109
Consumers, Toronto	,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	83
Mortgage, 6's	3,500,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	89½	92
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,325,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	104½	105½
" Bonds, 5's	10,500,000	..	107	108
Indianapolis	2,000,000	..	70	75
" Bonds, 6's	2,650,000	..	106½	108
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,823,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	..
Preferred	2,500,000	100	95	105
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218½
Nashville Gas Lt. Co	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¼
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	101⅜	101½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58½	58¾
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	94	96
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	102	..
Washington, D. C	2,600,000	20	306⅞	308½
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600,000	50	230	..

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(*Continued on page 976.*)

DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., June 14, 1905.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable July 15th, 1905, to stockholders of record at the close of business, June 30, 1905. Checks will be mailed.

1567-4 LEWIS LILLIE, Treasurer.

NOTICE!

PLEASE read the advertisement of the Empire Gas Improvement and Construction Company, on page 981. This Company employs only high-priced and quick-working mechanics, and all its work is guaranteed to be strictly first class, and will be finished at time specified.

A. M. SUTHERLAND,
1545-eot. tf 49 Wall Street.

WANTED,

A Situation as Superintendent of either a Coal or Water Gas Company,

By a man of 38. Fifteen years' experience. Can show the very best results in operation and increasing business. Can furnish best of references. Experienced in construction of gas, electric and water works.

1566-2 Address, "J. W. D.," care this Journal.

POSITION WANTED.

A good, all around gas man, with 12 years' experience in all lines, wishes to engage with some company which needs pushing. Can show results from present place per year. At present employed as superintendent of a plant with output of 60,000,000 annually. Best references.

Address, "TON,"
1566-tf Care this Journal.

Situation Wanted

As Superintendent or Manager of Gas Plant.

Twelve years' experience in manufacturing oil and water gas. Can give references.

Address, "J. B. N.," P. O. Box 250,
1567-1 Liberty, Union County, Ind.

WANTED,

Experienced Gas Maker,

To operate Lowe Improved Water Gas Set.

Address, "S. S. Y.,"
1567-2 Care this Journal.

ENGINEER WANTED.

Wanted, a competent engineer to take charge of the manufacturing and distribution of a large company. Must be a technical graduate and experienced in both branches of the business. This is a straight engineering job and a good opening for the right man. Applicants must be prepared to furnish references from present and past employers.

1567-3 Address, "X.," care this Journal.

WANTED,

TO BUY A GAS PLANT,

In a town of not not less than 10,000 population. Address,

CARROLL COLLINS,
1567-3 3 4 Main St., Elkhart, Ind.

WANTED,

An Analyst for a Gas Company.

Preference will be given to one who has had practical experience in testing gas and its by-products, coal and other material used in the production and purification of gas. State age, experience, and salary expected. References required.

Address, "X. Y. Z.,"
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Two One-half Million Holders. Steel tanks.
Six Exhausters, with 16-inch to 24 inch connections
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Sixteen Benches of 6's, with all of the ironwork, including cast iron hydraulic main.
Four Hazelton Boilers, 175-horse power each.
Twelve-Inch, 16-Inch, 20-Inch Gate Valves, inside and outside screws.
Twelve-Inch, 16-Inch and 20-Inch Cast and Wrought Iron Pipe and Apparatus for a 3-million capacity gas plant. Will be sold in whole or part at remarkably low figures for prompt removal. All apparatus in good, serviceable condition, and to be sold on account of enlargement and change of process. An excellent chance for any company to enlarge its works at a very low cost.

Address, W. A. ALLEN,
Engineer and Supt. New York Mutual Gas Light Company,
1563-5 Foot of East 11th Street, New York City.

FOR SALE. The Consumers Gas Trust Co., of Indianapolis, Ind., offers for sale its entire plant inside of the corporate limits of Indianapolis, consisting of all its high and low pressure mains, including all service connections belonging to the Consumers Gas Trust Co., reserving therefrom only cash in bank and bills, accounts and other moneys receivable, office fixtures and real estate at the southwest corner of Illinois and 22d streets. Sealed bids will be received until 12 o'clock noon on the 11th day of Sept., 1905. Each bid must be accompanied with a certified check on some bank or trust company in the city of Indianapolis for the sum of fifty thousand (50,000) dollars, payable to the company, which will be held as a forfeit as agreed and liquidated damages, without returning in whole or in part in case the bid is accepted and not fulfilled. The Consumers Gas Trust Co., by its directors, reserves the right to reject any or all bids. All bids and communications should be addressed to Horace McKay, Chairman of the Finance Committee, 31 North Pennsylvania Street, Indianapolis, Ind. There are no liens of any kind upon the property.

(Signed) HORACE McKAY,
Chairman Finance Committee.

Attest: BEMENT LYMAN,
Secretary.

Indianapolis, Ind., May 27th, 1905. [Seal.]
1566-3m

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

IMPROVED AMMONIA CONCENTRATOR.

About 100 in use. Write to

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MICHIGAN AMMONIA WORKS, - Detroit, Mich.

FIELD'S ANALYSIS FOR THE YEAR 1904.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 36th year of publication. Compiled and arranged by **JOHN W. FIELD**, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. **Price, $5.** For Sale by
A. M. CALLENDER & CO., 42 Pine St., New York City.

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Steam Turbine Dynamos
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Dravo, Doyle & Co., - - - - - Pittsburg, Pa.
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Works and Sales Offices, TRENTON, N. J.

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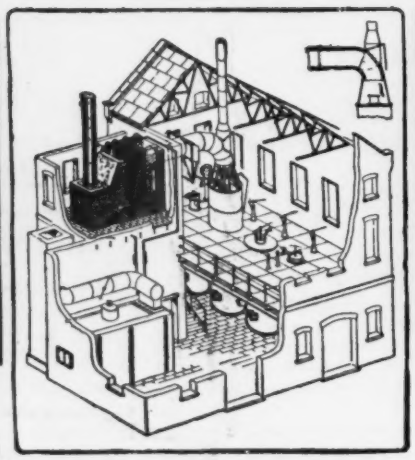
WE BUILD AND INSTALL MECHANICAL DRAFT PLANTS



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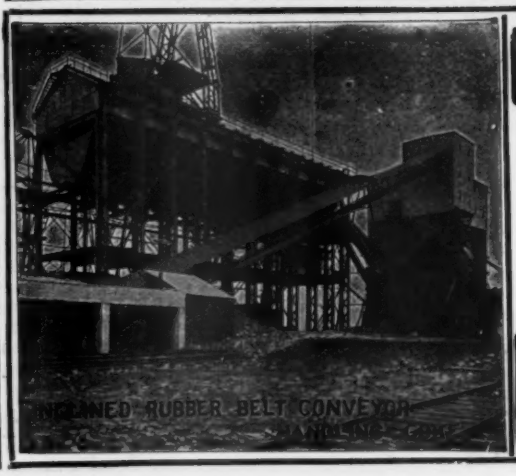

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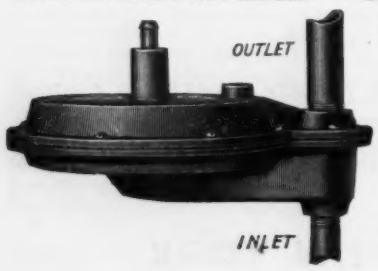

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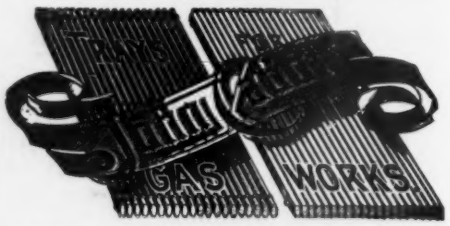

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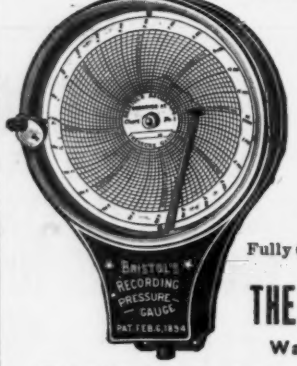

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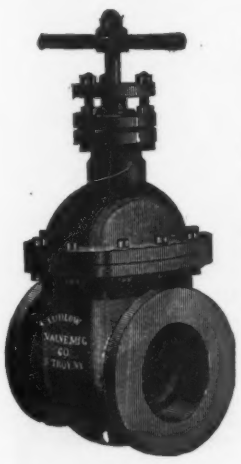

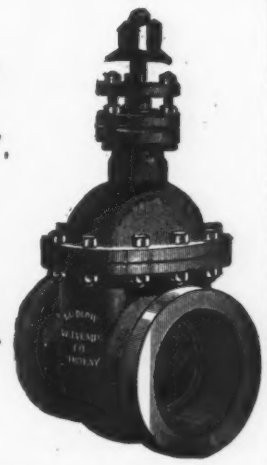

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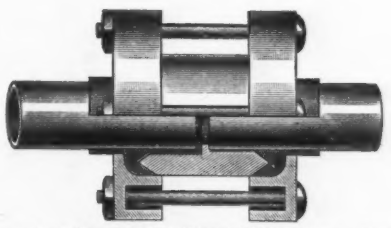

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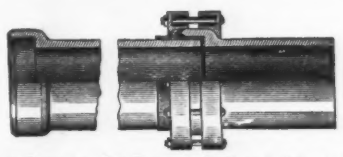

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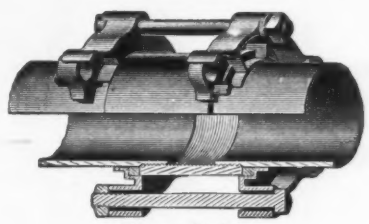

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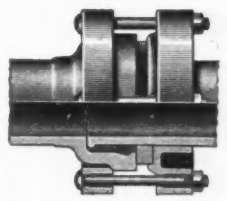

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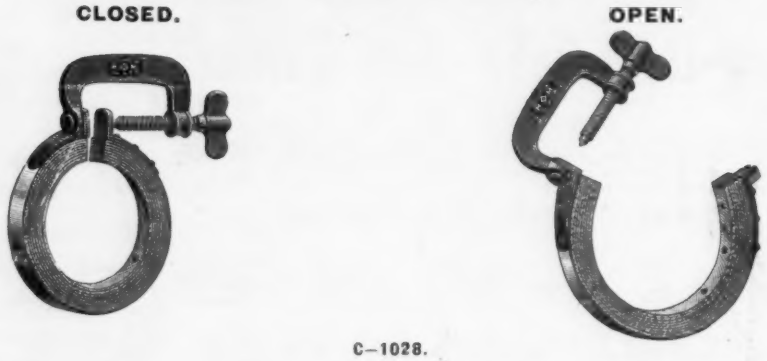

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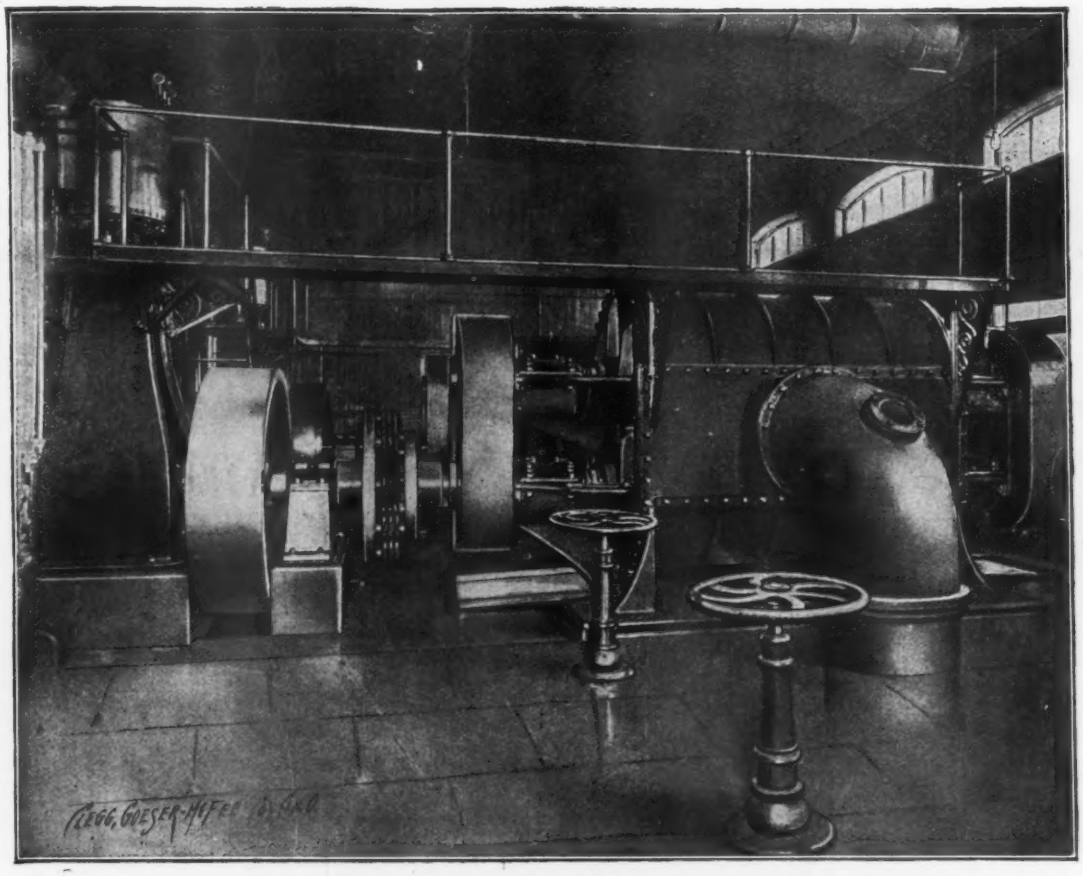

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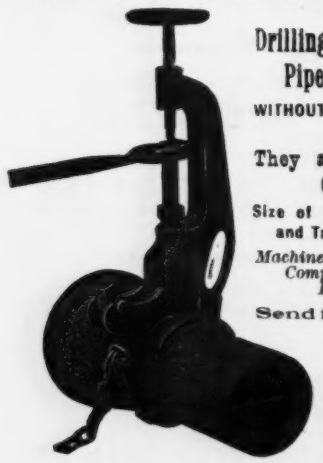

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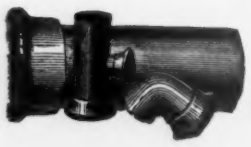

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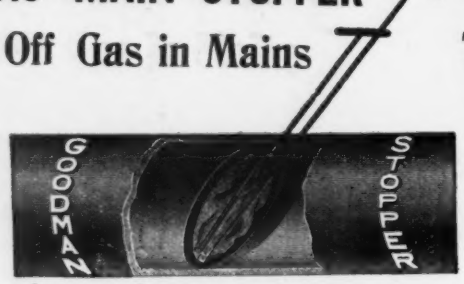

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This is No. 2.

Height, 36 inches.
Diameter, 12 "
Shipping weight, 80 lbs.
Net weight, 50 lbs.
The products of combustion are entirely separate from the water. Entire water surfaces are tinned.

Price, $35.00.

HOT WATER

FOR BATHROOM AND KITCHEN

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Humphrey Crescent Instantaneous Water Heater.

Prices range from $20 to $45.
Every Heater GUARANTEED.

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The only manufacturers in the World of a COMPLETE LINE OF INSTANTANEOUS WATER HEATERS.

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Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
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CHEMICAL ENGINEER
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P. O. BOX 2043, PHILADELPHIA, PA.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

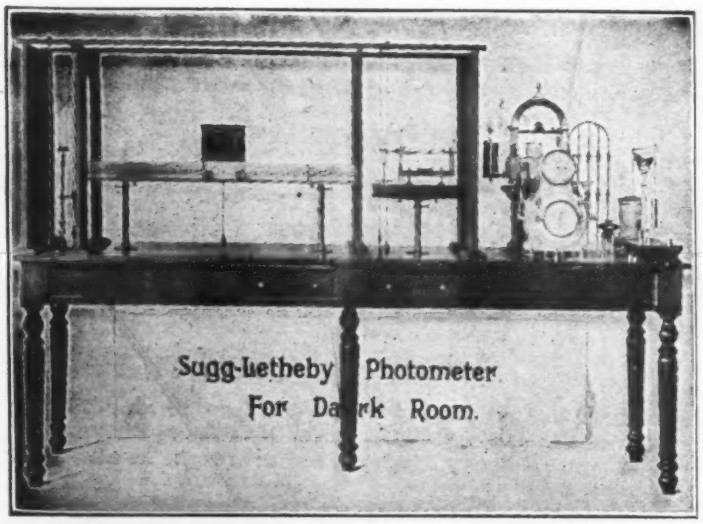
JULY, 1905.

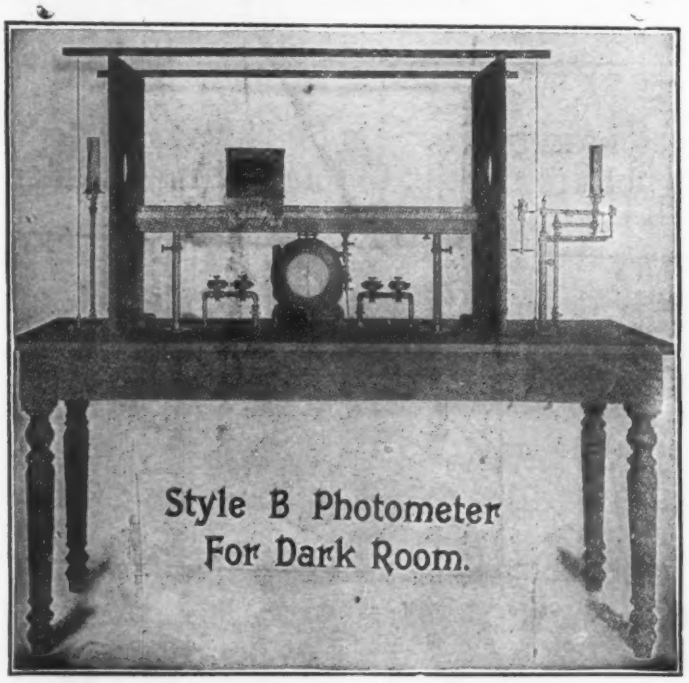
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Sat.	1	8.00 PM	3.30 AM
Sun.	2	8.00 NM	3.40
Mon.	3	8.00	3.40
Tue.	4	8.00	3.40
Wed.	5	8.00	3.40
Thu.	6	8 00	3.40
Fri.	7	9.50	3.40
Sat.	8	10.30	3.40
Sun	9	11.00 FQ	3.40
Mon.	10	11.40	3.40
Tue.	11	12.20 AM	3.40
Wed.	12	1.00	3.40
Thu.	13	1.50	3.40
Fri.	14	2.50	3.40
Sat.	15	No L.	No L.
Sun.	16	No L. FM	No L.
Mon.	17	No L.	No L.
Tue.	18	8.00 PM	9.50 PM
Wed.	19	8.00	10.20
Thu.	20	8.00	10.50
Fri.	21	8.00	11.20
Sat.	22	8.00	11.50
Sun.	23	7.50	12.20 AM
Mon.	24	7.50 LQ	12.50
Tue.	25	7.50	1.20
Wed.	26	7.50	2.00
Thu.	27	7.50	2.40
Fri.	28	7.50	3.50
Sat.	29	7.50	3.50
Sun.	30	7.40	4.00
Mon.	31	7.40 NM	4.00

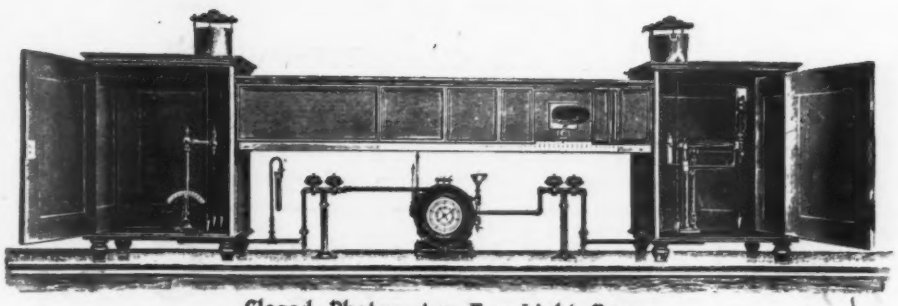
TOTAL HOURS DURING 1905.

By Table No. 1.

	Hrs.Min.
January	240.50
February	192.20
March	207.00
April	175.10
May	161.00
June	139.50
July	149.00
August	161.50
September	173.00
October	205.00
November	211.00
December	229.00
Total, yr.	2245.00







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

JULY, 1905.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light	Extinguish.
		P.M.	A.M.
Sat.	1	7.30	3.15
Sun.	2	7.30	3.15
Mon.	3	7.30	3.15
Tue.	4	7.30	3.15
Wed.	5	7.30	3.15
Thu.	6	7.30	3.15
Fri.	7	7.30	3.15
Sat.	8	7.30	3.15
Sun.	9	7.30	3.15
Mon.	10	7.30	3.15
Tue.	11	7.30	3.15
Wed.	12	7.30	3.15
Thu.	13	7.30	3.15
Fri.	14	7.30	3.15
Sat.	15	7.30	3.15
Sun.	16	7.20	3.15
Mon.	17	7.20	3.15
Tue.	18	7.20	3.15
Wed.	19	7.20	3.15
Thu.	20	7.20	3.15
Fri.	21	7.20	3.15
Sat.	22	7.20	3.15
Sun.	23	7.20	3.15
Mon.	24	7.20	3.15
Tue.	25	7.20	3.15
Wed.	26	7.20	3.15
Thu.	27	7.20	3.15
Fri.	28	7.20	3.15
Sat.	29	7.20	3.15
Sun.	30	7.10	3.30
Mon.	31	7.10	3.30

TOTAL HOURS DURING 1905.

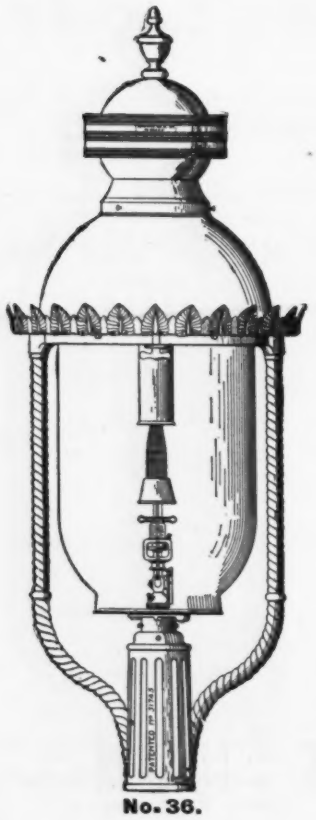
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 57 Liberty Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

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Uniformly SUCCESSFUL in 150 Cities and Towns.

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POINTS OF MERIT:

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IT LIGHTS THE STREET.

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No. 38.

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The formula is simple---

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

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And your profit isn't merely dollars and cents.

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For the Year Ending December 31st, 1904, has been Awarded Contracts for 45 Sets of

Standard Double-Superheater Lowe Water Gas Apparatus.

PARTIAL LIST OF PLACES:

Harrisburg, Pa.
Pelham, N. Y.
Reading, Pa.
Augusta, Me.
Bangor, Pa.
Woonsocket, R. I. (2d contract).
Brooklyn, N. Y. (4th contract).
Cincinnati, O. (2d contract).
Scranton, Pa. (3d contract).
New York City (14th contract).
New Haven, Conn. (2d contract).
Watertown, N. Y.
Tampa, Fla. (3d contract).
Westchester, N. Y. (3d contract).
Bridgeport, Conn. (2d contract.)
St. Paul, Minn. (2d contract).
Springfield, Mass. (2d contract).
Lynn, Mass. (5th contract).
Rochester, N. Y.
Battle Creek, Mich.
Mechanicsburg, Pa.
Excelsior Springs, Mo.
Bristol, Conn.
Jersey Shore, Pa.
Vicksburg, Miss.

TOTAL SETS, 1904, ... 45
TOTAL DAILY CAPACITY, 1904, ... 56,325,000 cubic feet.
TOTAL SETS TO DATE, ... 553
TOTAL DAILY CAPACITY, ... 419,180,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
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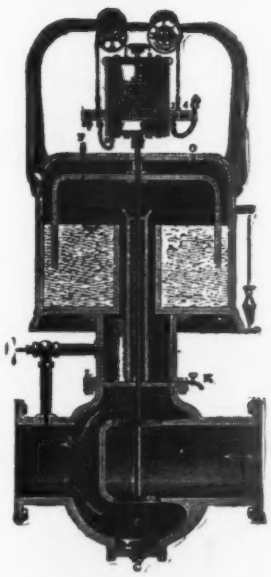

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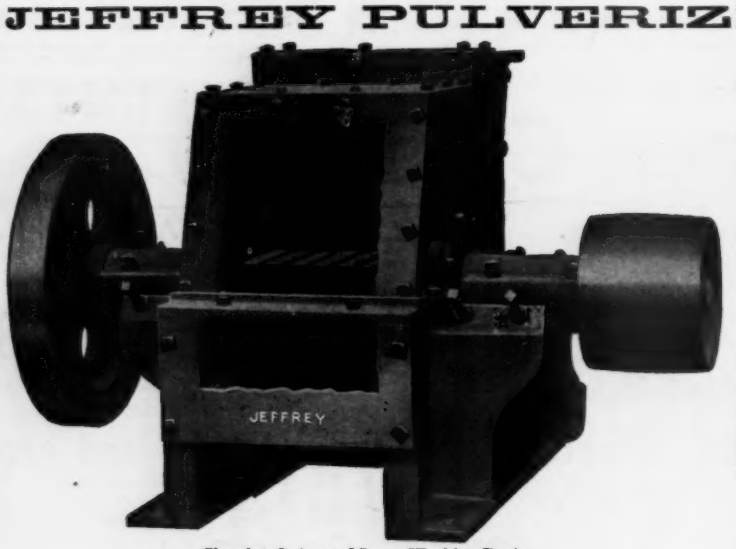

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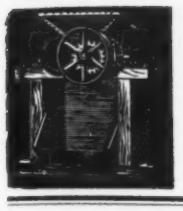

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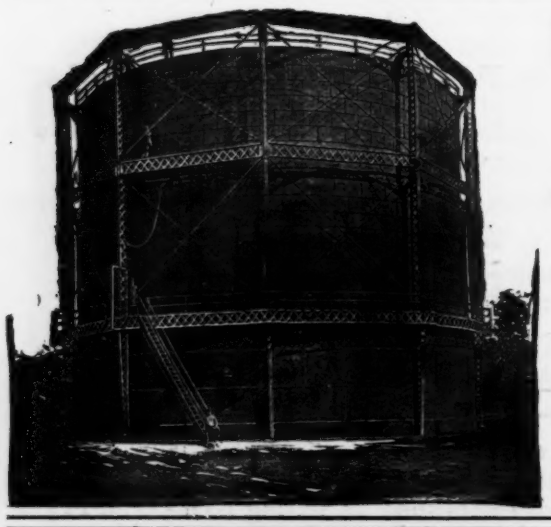

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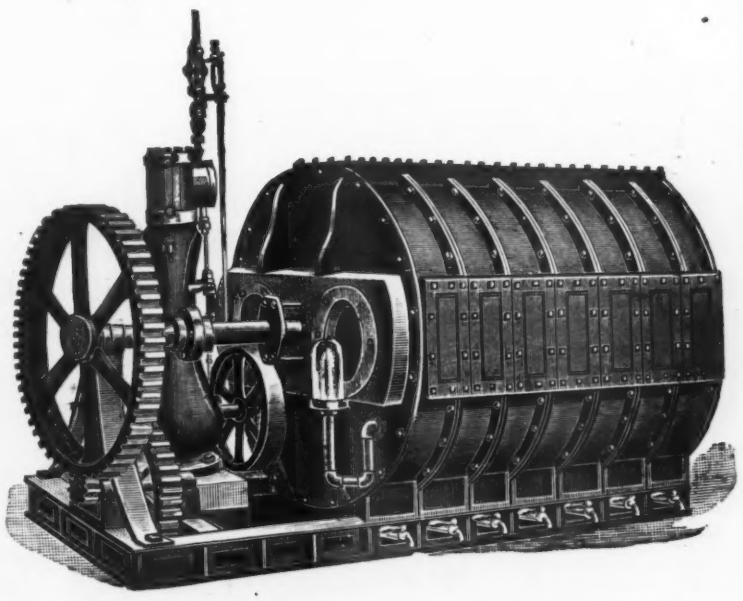

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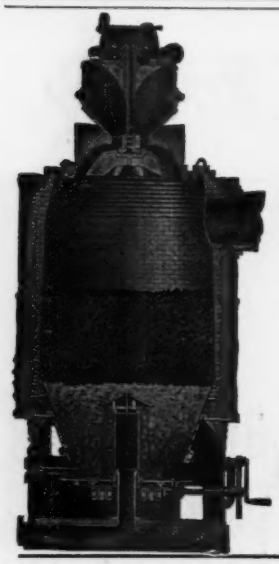

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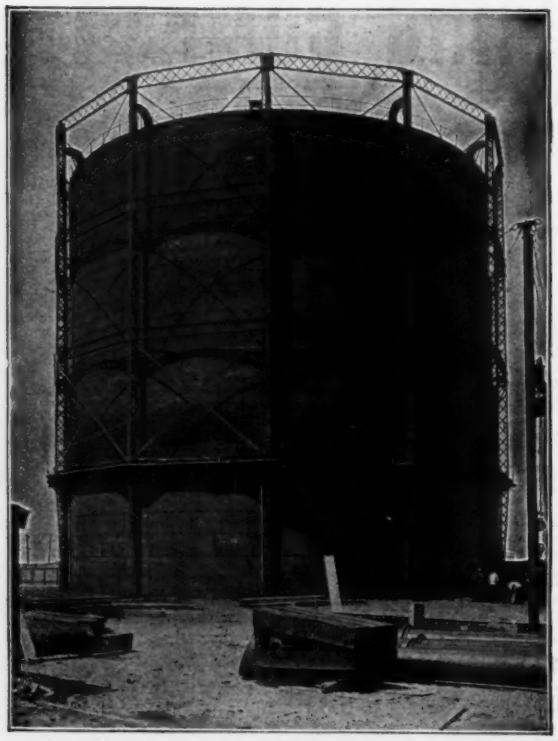

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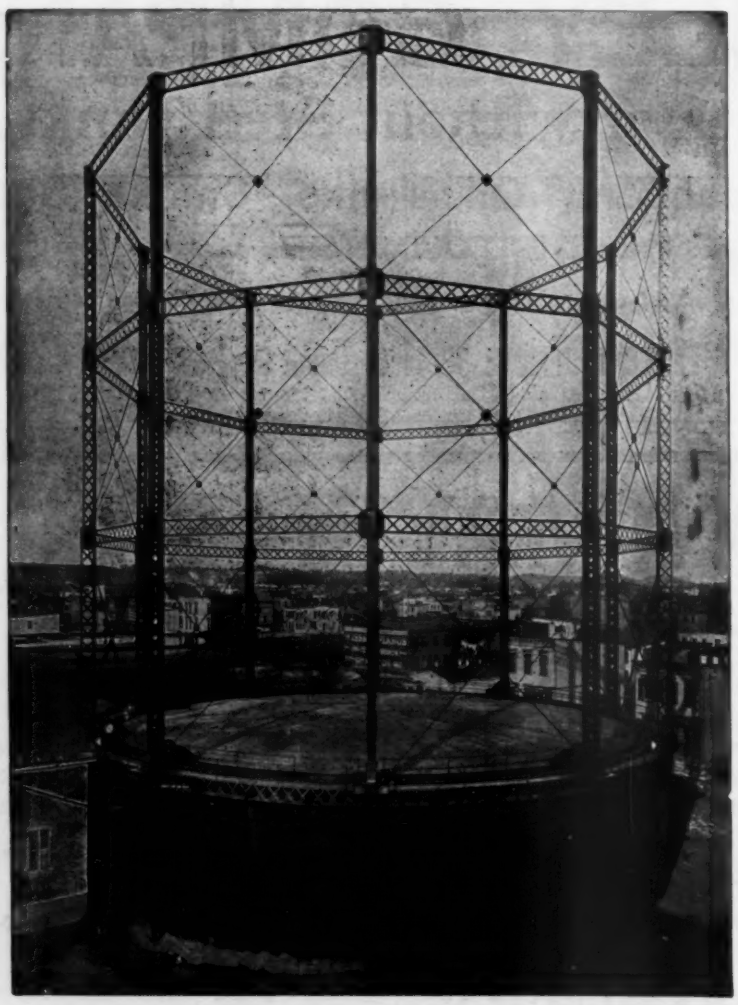

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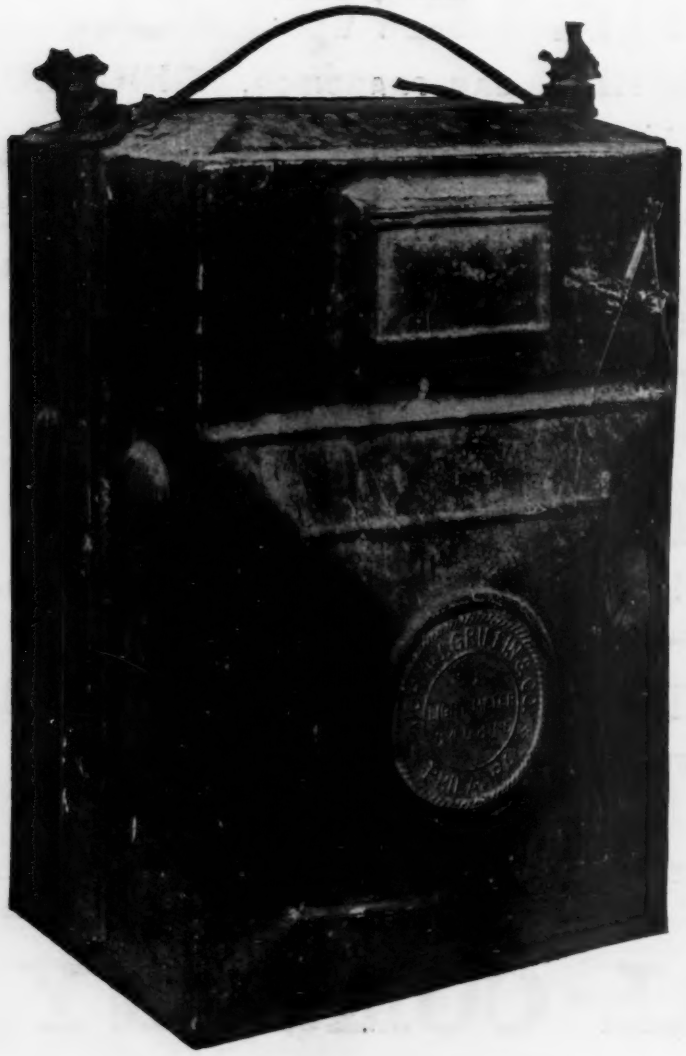

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